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Facility Effluent Monitoring Plan for the Plutonium-Uranium Extraction Facility

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J. L. Geiger

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Part 1

FACILITY EFFLUENT MONITORING PLAN FOR THE PLUTONIUM-URANIUM EXTRACTION FACILITY

J. M. Nickels

ABSTRACT

A facility effluent monitoring plan is required by the U.S. Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. A facility effluent monitoring plan determination was performed during Calendar Year 1991 and the evaluation requires the need for a facility effluent monitoring plan. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438**. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.*

This facility effluent monitoring plan shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated, as a minimum, every three years.

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*General Environmental Protection Program, *DOE Order 5400.1, U.S. Department of Energy, Washington, D.C., 1988.*

**A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, *WHC-EP-0438, Westinghouse Hanford Company, Richland, Washington, 1991.*

This facility effluent monitoring plan has been revised to include Department of Energy/Westinghouse Hanford Regulatory Analysis comments, procedure changes (revisions), and improved U.S. Environmental Protection Agency (40 Code of Federal Regulations Part 61, Subpart H) National Emission Standards for Hazardous Air Pollutants point-by point evaluation.

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AEA	alpha energy analysis
AFAN	ammonium fluoride and ammonium nitrate
AMU	aqueous makeup
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BAT	best available technology
CAM	continuous air monitor
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	Code of Federal Regulations
CPRM	continuous particulate release monitor
CY	calendar year
DCG	derived concentration values
DOE	U.S. Department of Energy
DOP	di-octyl phtahalate
Ecology	Washington State Department of Ecology
EDE	effective dose equivalent
EMP	Environmental Monitoring Plan
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
FEMP	Facility Effluent Monitoring Plan
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
HEPA	high-efficiency particulate air (filter)
HP	health physics
HVAC	heating, ventilating, and air conditioning
IC	ion chromatography
ICRP	International Commission on Radiological Protection
ISE	ion-specific electrode
LICCS	Laboratory Instrument Calibration Control
M/S	monitoring/sampling
MCA	multichannel analyzer
MCL	maximum contaminant levels
MEI	maximally exposed individual
MFRAM	moving filter radioactive aerosol monitor
MS	mass spectrometer
NESHAP	National Emission Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NPDES	National Pollutant Discharge Elimination System
OEC	Operations and Engineering Contractor
OHS	occupational health and safety
PAO	Public Affairs Office
PM	preventive maintenance
PNL	Pacific Northwest Laboratory
PR	product removal

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LIST OF TERMS (continued)

PSD	prevention of significant deterioration
PUREX	Plutonium-Uranium Extraction
QA	quality assurance
QAPjP	Quality Assurance Project Plan
QAPP	Quality Assurance Program Plan
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy Field Office, Richland
RPR	radiological problem report
SALDS	State Approved Land Disposal Structure
SQA	Safety and Quality Assurance
TDS	total dissolved solids
TEDF	Treated Effluent Disposal Facility
TLD	thermoluminescent dosimeter
TOC	total organic carbon
TOX	total organic halides
TSD	treatment, storage, or disposal
WAC	Washington (State) Administrative Code
Westinghouse Hanford	Westinghouse Hanford Company

GLOSSARY

AEA	Alpha energy analysis, a method of identifying a radionuclide by the energy of its alpha ray emissions.
AFAN	An aqueous solution containing both ammonium fluoride and ammonium nitrate.
AMU	Aqueous makeup, a section of the plant used for preparing aqueous solutions.
ASD	Ammonia Scrubber Condensate, the distillate produced by the ammonia scrubber waste concentrator.
B Pond	A ground disposal pond system, comprising the 216-B-3 Pond and its expansion lobes, 216-B-3A, 216-B-3B, and 216-B-3C.
CAM	Continuous air monitor, an instrument used to provide near real-time warning of excessive airborne radioactive contamination.
CHI/Q	Atmospheric dispersion factor.
CPRM	Continuous Particulate Release Monitor, one of the process control monitors on the 291-A-1 stack.
CSL	Chemical Sewer, the PUREX building services effluent.
CWL	Cooling Water, the very low risk heat-exchange effluent from the PUREX plant. Historically, this has included both condensed steam and cooling water.
DOP	Di-octyl phthalate, specifically, bis(2-ethylhexyl) phthalate used for testing high-efficiency particulate air filter efficiency.
P&O Gallery	The section of the 202-A Building that provides service piping and electrical connections to the canyon.
PDD	Process Condensate, the waste distillate produced by the uranium concentrators in the PUREX plant.
PUREX	Plutonium-Uranium Reduction Extraction, a process for separating fission products and actinides from irradiated nuclear fuel. Also the plant at the Hanford Site that uses the PUREX process. The PUREX process uses solvent extraction technology to effect continuous separation with minimal waste, and is notable for producing decontaminated product streams for both uranium and plutonium.
Sievert	The amount of radiation exposure that produces the same tissue damage as an x-ray dose that deposits one Joule of energy per kilogram of tissue. 100 REM.

GLOSSARY (continued)

SCD	Steam Condensate, the moderate risk heat-exchange effluent from the PUREX plant. Historically, this has included both condensed steam and cooling water.
SWP	The anticontamination clothing used at the Hanford Site. The *SWP Lobby* contains the entrance to the major part of the accessible potentially contaminated area in the PUREX plant and is adjacent to one of the SWP change rooms.
Tri-Party Agreement	The *Hanford Federal Facility Agreement and Consent Order*, an agreement between the DOE, EPA, and Ecology relating to environmental issues at the Hanford Site.

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FACILITY EFFLUENT MONITORING PLAN FOR PLUTONIUM-URANIUM EXTRACTION PLANT

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Order 5400.1 (DOE 1988a) requires a Facility Effluent Monitoring Plan (FEMP) be prepared for each DOE facility that has gaseous and/or liquid effluents. Only effluents that release significant pollutants or hazardous materials are included in this order; sanitary sewer and exhausts from air heating or cooling equipment are exempt.

The Plutonium-Uranium Extraction (PUREX) Plant is transitioning into a standby mode. No processing activities are occurring and the majority of the tanks have been emptied. One wastewater discharge and eleven air exhaust stacks are active. One previous air discharge and four previous wastewater discharges have been eliminated.

1.1 POLICY

It is the policy of DOE and Westinghouse Hanford Company (Westinghouse Hanford) to conduct effluent monitoring that is adequate to determine whether the public and environment are adequately protected during DOE operations and whether operations are in compliance with DOE and other applicable federal, state, and local radiation standards and requirements. It is also DOE and DOE contractor policy that effluent monitoring programs meet high standards of quality and credibility.

1.2 PURPOSE

The purpose of this FEMP is to (1) identify and evaluate the gaseous and liquid effluents from the PUREX Plant through characterization, (2) determine the discharge criteria, and (3) establish a program to ensure compliance with those discharge criteria. Compliance is determined by a thorough monitoring program that uses the correct sampling locations, laboratory analyses, sample and data handling, quality assurance (QA)/quality control (QC) procedures and notification/reporting requirements.

1.3 SCOPE

Specific sections that detail how the FEMP is implemented and structured follow. They compose the scope of this document.

Section	Scope
2.0	This brief facility description summarizes the processes that produce the effluents and couples them with a listing of effluents.
3.0	DOE orders and federal and state regulations that establish FEMP requirements and discharge criteria are summarized.
4.0	Each gaseous and liquid effluent is characterized. Routine and upset conditions are described. The discharge criteria are developed and listed.
5.0	A description of each effluent's discharge point is given.
6.0	The design criteria of the monitoring/sampling (M/S) system are listed for both air and water effluents.
7.0	Instrument descriptions and specifications of the effluent monitoring system are given.
8.0	Appropriate historical M/S data are summarized.
9.0	Analytical requirements are listed and coupled with sampling and sample handling procedures.
10.0	Notification and reporting requirements for routine and environmental occurrence reports and procedural changes are listed.
11.0	This section provides the interface of the FEMP with the operational environmental surveillance program.
12.0	The QA plan governing the field activities, laboratory analysis, and record keeping is stated. Audits are also covered.
13.0	Internal and external FEMP review requirements are given.
14.0	Compliance assessment is summarized. A point-by-point evaluation of the NESHAPs is included.

15.0 A summary is provided and conclusions are listed.

16.0 References and acceptance criteria used in the FEMP are listed.

1.4 DISCUSSION

The characterization of the radioactive and nonradioactive constituents in each effluent stream coupled to the regulatory framework provide the underlying rationale for the M/S programs. The method of characterization discussed in this plan identifies potential pollutants in their individual effluents. Characterization parameters are based on process knowledge, chemical, and equipment use. An accurate description of the effluent's point of discharge is required for emission modeling and location of end-of-the-pipe M/S stations. Both normal and upset (either projected or actual) conditions are characterized.

As stated in federal regulations [40 Code of Federal Regulations (CFR) 61, Subpart H] (EPA 1989a), when determining the upset condition of an effluent, the emission controls between the point of generation and the discharge point are not to be considered. The emission controls are to be considered when assessing the types and amounts of a pollutant at the discharge point during normal operating conditions.

The effluent monitoring system must have the appropriate design criteria and technical specifications to fully characterize the effluent streams. A combination of continuous sensing, continuous or periodic sampling, and parameter-specific monitoring may be used.

Proper sampling, analysis, and data recording of all effluent monitoring efforts provide defensible documentation that all appropriate discharge criteria are being met at the point of discharge.

Characterization of liquid waste pollutants is required by 40 CFR 261.3(b) (EPA 1989b). Other regulations, such as 40 CFR 61, Subpart H (EPA 1989a), provide guidance on the adequacy of gaseous effluent monitoring. However, all potential pollutants should be characterized for two reasons: (1) to assess the preventive capabilities of engineered and administrative barriers and the consequences of an upset release due to failure of one of these barriers, and (2) to verify that the M/S programs address all pertinent constituents at the point of discharge.

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2.0 FACILITY DESCRIPTION

This chapter presents a brief facility and process description of the PUREX Plant. These descriptions include the following:

- Location and physical layout of the process facility
- General description of the present, past, and future activities of the process
- Identity of the wastestreams.

Chapter 4.0, Identification/Characterization of Effluent Streams, provides further specific information on the gaseous and liquid effluents.

2.1 BRIEF FACILITY PHYSICAL LAYOUT

The PUREX Plant is a collection of buildings and facilities located in the 200 East Area of the Hanford Site, in the southeastern region of Washington State. The main building, 202-A (Figure 2-1), is a heavily shielded, reinforced concrete structure known as a "canyon" building. This building contains the main equipment used in the PUREX process. Figure 2-2 is a plot plan for the PUREX Plant.

Principal buildings and structures, which have the greatest connection to gaseous and liquid effluents, are described in the following sections.

2.1.1 The 202-A Building

The 202-A Building, in which the fuels are processed, is a reinforced concrete structure 1,005 ft long, 119 ft wide at its maximum, and 100 ft high, with about 40 ft of this height below grade. The building consists of three main structural components: (1) a thick-walled, concrete canyon in which the equipment for radioactive processing is contained; (2) the pipe and operating (P&O), sample, and storage galleries; and (3) a steel-and-transite annex that houses offices, process control rooms, laboratories, and the building services. The basic features and arrangement are shown by the cut-away perspective view in Figure 2-1. The portion of the canyon below grade is subdivided into a row of process equipment cells paralleled by a ventilation air tunnel and a pipe tunnel through which intercell solution transfers are made. The air tunnel exhausts the ventilation air from the cells to the main ventilation filters and stack.

Running nearly the full length of the canyon building, above the cells and pipe trench, is a craneway for three gantry-type maintenance cranes. These cranes are used to handle cell cover blocks, remotely remove and replace process cell equipment, and charge irradiated fuel into the dissolvers.

The galleries contain service piping to the cells, samplers for obtaining process samples, and electrical switchgear.

The service section, next to the galleries, consists of two separate annexes. The larger annex contains the maintenance shops, offices, lunchroom, locker room, radiation zone entry lobby (SWP lobby), blower room, a switchgear room, compressor room, central control room, and the aqueous makeup (AMU). The smaller annex contains the analytical laboratory, the headend control room, and a switchgear room.

2.1.2 203-A Pumphouse and Tank Farm

The 203-A Pumphouse contains instruments for measuring the volumes of solutions contained in the 203-A tank farm, and pumps and piping to receive and transfer the solutions in the tank farm. The tank farm stores aqueous uranium nitrate products, recycled nitric acid from the Uranium Trioxide (UO_3) Plant, and contaminated uranium nitrate solution. The tank farm includes sampling equipment, as well as loading and unloading equipment for the tank trucks and cars used to transfer solutions between the PUREX Plant and the UO_3 Plant. This area is called out in Figure 2-2 as the 203-A Storage Area.

2.1.3 211-A Pumphouse and Tank Farm

The 211-A Pumphouse is located in the midst of the 211-A Tank Farm. The pumphouse contains pumps used to transfer the chemicals stored in the tank farm. The pumphouse also contains ion-exchange columns and ancillary equipment used to produce demineralized water from sanitary (potable) water. The 211-A Tank Farm stores bulk liquid chemicals for use in the PUREX process. The chemicals stored include 57 wt% nitric acid, 93 wt% sulfuric acid, 50 wt% sodium hydroxide, 45 wt% potassium hydroxide, as well as demineralized water, normal paraffin hydrocarbon, tributyl phosphate, and aluminum nitrate. This tank farm once stored an aqueous mixture of ammonium flouride and ammonium nitrate (AFAN), but the AFAN has been removed. This area is called out in Figure 2-2 as the 211-A Demineralizer Building.

2.1.4 206-A Acid Fractionator Building

The 206-A Building is a reinforced concrete structure located adjacent to the 202-A Building. It houses the vacuum fractionator and associated equipment. The vacuum fractionator concentrates recovered nitric acid. The heat transfer piping in the vacuum fractionator is a major contributor to the PUREX Plant Chemical Sewer (CSL) waste stream during operation. During standby conditions there is no discharge from the factionator to the CSL. This building is called out in Figure 2-2 as the 206-A Fractionator.

2.1.5 The 293-A Building

The 293-A Building houses the back-up facility, which removes nitrogen oxides from the dissolver off-gas stream, converting them to nitric acid. The nitric acid is then recycled into the PUREX process via the 206-A Building. This process does not operate during standby conditions.

2.1.6 Effluent-Monitoring Buildings

Several small buildings and other enclosures contain equipment needed to monitor various liquid and gaseous effluent streams. The 295-XX Buildings house M/S equipment for the wastewater streams. The 292-XX Buildings house M/S equipment for the gaseous effluent streams. Additional stack sampling equipment is located in small enclosures (cabinets) near some exhaust stacks.

2.1.7 Tank 216-A-5 Calcium Carbonate Neutralization Tank

This tank contains calcium carbonate (crushed limestone), which ensures that the Process Condensate (PDD), would not exceed the 2.0 pH limit if upstream neutralization systems did not perform as expected. This tank, like the PDD, is not in service during standby. Reuse of this tank is not anticipated.

2.1.8 Railroad Tunnel

The railroad tunnel receives irradiated fuel that has been transported to PUREX via railcars. The railroad tunnel enters the north side of the east end of Building 202-A, continues through the building, then exits on the south side of the building where it connects to the storage tunnels. The storage tunnels are two parallel, earth-covered tunnels that contain railroad tracks. The storage tunnels are isolatable from the railroad tunnel by water-fillable doors. The tunnels contain failed equipment (loaded on railroad cars) that is contaminated with high levels of radioactivity or that is too bulky for immediate burial. Storage of the equipment allows the radioactivity to decay to less dangerous levels. During standby conditions, PUREX will not receive railcar fuel shipments.

2.1.9 The 291-AE Building

Building 291-AE is an abovegrade concrete structure that houses the No. 4 filter system. The No. 4 filter consists of 10 parallel banks of two-stage high-efficiency particulate air (HEPA) filters for final filtration of the canyon exhaust system. Instrumentation for pressure drop across each stage and gamma radiation at the first stage is part of the filter.

2.2 BRIEF PROCESS DESCRIPTION

The PUREX Plant separates usable actinides from fission products in irradiated nuclear fuel. Briefly, the process consists of dissolving the fuel and then separating the actinides using liquid-liquid solvent extraction. The driving forces for the separations consist of concentration changes, temperature changes, and chemical additions. The PUREX Plant has been the source of five liquid effluent streams, which are mostly by-products of the chemical separation processes. These liquid effluent streams are the CSL, the Steam Condensate (SCD), the PDD, the Ammonia Scrubber Condensate (ASD), and the Cooling Water (CWL) streams. The PUREX Plant has been the source of 11 principal gaseous effluent streams that resulted from the control of process vapors/gases and potential contamination. Of the 11 PUREX stacks only 10 discharge at any one time; see Section 4.1.1, Stacks 296-A-5A and 296-A-5B. There are also six minor gaseous effluent streams that result from building ventilation of noncontaminated, normally occupied areas. There are also approximately 50 exhaust points that are exempt from regulation, such as lavatory, office, and lunch room exhausts.

One of these stacks (296-A-24) was deactivated in early 1990, leaving 10 principal streams. During the current standby condition of the PUREX Plant, the remaining gaseous effluents will continue. Continuous air flow through the process areas will ensure control of trace quantities of contamination. The building ventilation may be changed in the future and affect the six minor gaseous effluents. Of the five liquid effluent streams, the ASD, PDD, SCD, and CWL have been eliminated. Residual flow through the heat exchange equipment and heating, ventilation, and air conditioning (HVAC) systems will maintain some discharge (primarily building heating and cooling) from the CSL, but at a reduced rate.

2.3 IDENTIFICATION/CHARACTERIZATION OF POTENTIAL SOURCE TERMS

Source terms for effluents from the PUREX Plant depend on the building or process they originate from and whether the plant is on operating or standby mode. This document has been written to address the current standby status of PUREX.

2.3.1 Gaseous Effluents

The contributors to a gaseous effluent are linked by physical location and are not related to a specific process. The PUREX Plant has 10 major effluents with the potential to release radioactive and nonradioactive constituents in excess of DOE and U.S. Environmental Protection Agency (EPA) monitoring requirements (see Chapter 3.0). It also has six minor gaseous effluents that have little potential for release of hazardous constituents.

The PUREX main exhaust stack (291-A-1) exhausts the offgas from a number of sources.

- Vapor from the dissolvers when they are not operating
- Vent gases from the nitric acid absorber (T-XB) when dissolvers are operating
- Vent gases from the condenser on the nitric acid absorber E-F5
- Gases from the vessel vent system

- Gases from the condenser vent system
- Building ventilation air.

The product removal (PR) room stack (296-A-1) exhausts air from the following areas:

- PR Room and Hoods
- N Cell
- Q Cell
- PR Corridor
- Hot Shop Lobby.

The 296-A-2 stack exhausts sampler hoods from the west end of the sample gallery.

The 296-A-3 stack exhausts sampler hoods from the east end of the sample gallery. Stack 296-A-3 is being evaluated for deactivation during plant standby. If this stack is shut down, stack 296-A-2 will exhaust the hoods.

Stacks 296-A-5A and 296-A-5B, the west and east laboratory exhausts, do not operate concurrently; only one is operational at any given time. These stacks exhaust the PUREX analytical laboratory and are considered to be a single release point in this document.

The 296-A-6 stack exhausts room air from the east end of the sample gallery and from U Cell.

The 296-A-7 stack exhausts room air from the west end of the sample gallery and from R Cell.

The 296-A-8 stack exhausts filtered air from the west end of the P&O gallery, known as the white room.

The 296-A-10 stack exhausts room air from the No. 2 storage tunnel. This tunnel stores used equipment, as discussed in Section 2.1.8.

The 296-A-14 stack exhausts room air from the 293-A backup facility. This building contains two absorption columns for nitric acid recovery from the dissolver offgases.

Fuel decladding operations result in the formation of gaseous ammonia in certain D-Cell, E-Cell, and F-Cell vessels. The 296-A-24 stack provides a filtered exhaust for these vessels.

The six minor gaseous effluents are discharged from five wall exhausters and the AMU roof exhauster. The wall exhausters provide air circulation for the P&O Gallery. Currently three of the wall exhausters are active. These exhausters are being evaluated for deactivation. An engineering study has been completed with plans to deactivate the exhausters and seal the dampers closed. The AMU roof exhauster provides air circulation for the basement, second, and third floors of the AMU of the 202-A Building.

2.3.2 Liquid Effluents

Removal of the protective cladding from the fuel, the first step in fuel dissolution, produces large quantities of gaseous ammonia. This ammonia is scrubbed from the offgas with water to prevent the release of ammonia to the air and to alleviate the explosion hazard that the ammonia would otherwise present. The resulting ammonia solution, contaminated with radionuclides from the fuel, is then boiled to remove the radionuclides. Before 1987, the resulting ammonia-bearing condensate stream was released as the ASD. In the current standby mode, the ASD does not exist and is mentioned as historical fact only.

Concentration changes within the PUREX process solutions are provided by dilution with water or acid and by removal of water (and sometimes nitric acid) by boiling. Chemical additions to the process solutions add water, which must be removed in the concentration stages. Although most of the water that is boiled out of solutions is reused in dilution stages, there is some excess water that requires disposal. This water is the source of the PDD. Because PUREX is in a standby mode and not processing, the PDD does not exist and is mentioned as historical fact only.

Boiling process solutions and condensing the resulting vapors require the use of steam and cooling water. These processes produce steam condensate and warm water as effluents. Changing the temperatures of process solutions to drive the separations produces more steam condensate and warm water. This steam condensate and warm water constitute most of the liquid effluents from PUREX, namely, the CWL, SCD, and most of the CSL streams.

Ventilation, heating, water services, and room drainage contribute the remainder of the CSL. Room drainage consists of wastewater from shower rooms, water coolers, housekeeping, air compressors, and steam, water, and occasional chemical leaks. To minimize the potential for chemical leaks during standby, nonessential chemical headers have been emptied. Chemicals which are not needed for standby have been or are being removed from the plant.

Figure 2-3 shows the PUREX Plant liquid effluent system.

Within the operating history of PUREX, the various wastewater streams have been discharged to several ponds and cribs as follows.

Stream	Discharged to
PDD	216-A-5, 216-A-10, and 216-A-45 Cribs
SCD	216-A-30 and 216-A-37-2 Cribs, occasionally 216-B-3 Pond
ASD	216-A-36B Crib, UGS
CSL, CWL	216-B-3 Pond, CWL sometimes to 216-A-25 Gable Mt. Pond

During the existing standby mode, the PDD, ASD, SCD, and CWL waste streams are eliminated. The potential for contamination via the CSL waste stream will be eliminated after the recommended best available technology (BAT) to control effluent quality is implemented in accordance with DOE Order 5400.5 (DOE 1990a). The BAT for the CSL includes eventual routing to the Treated Effluent Disposal Facility (TEDF). The BAT will be implemented before a restart of PUREX.

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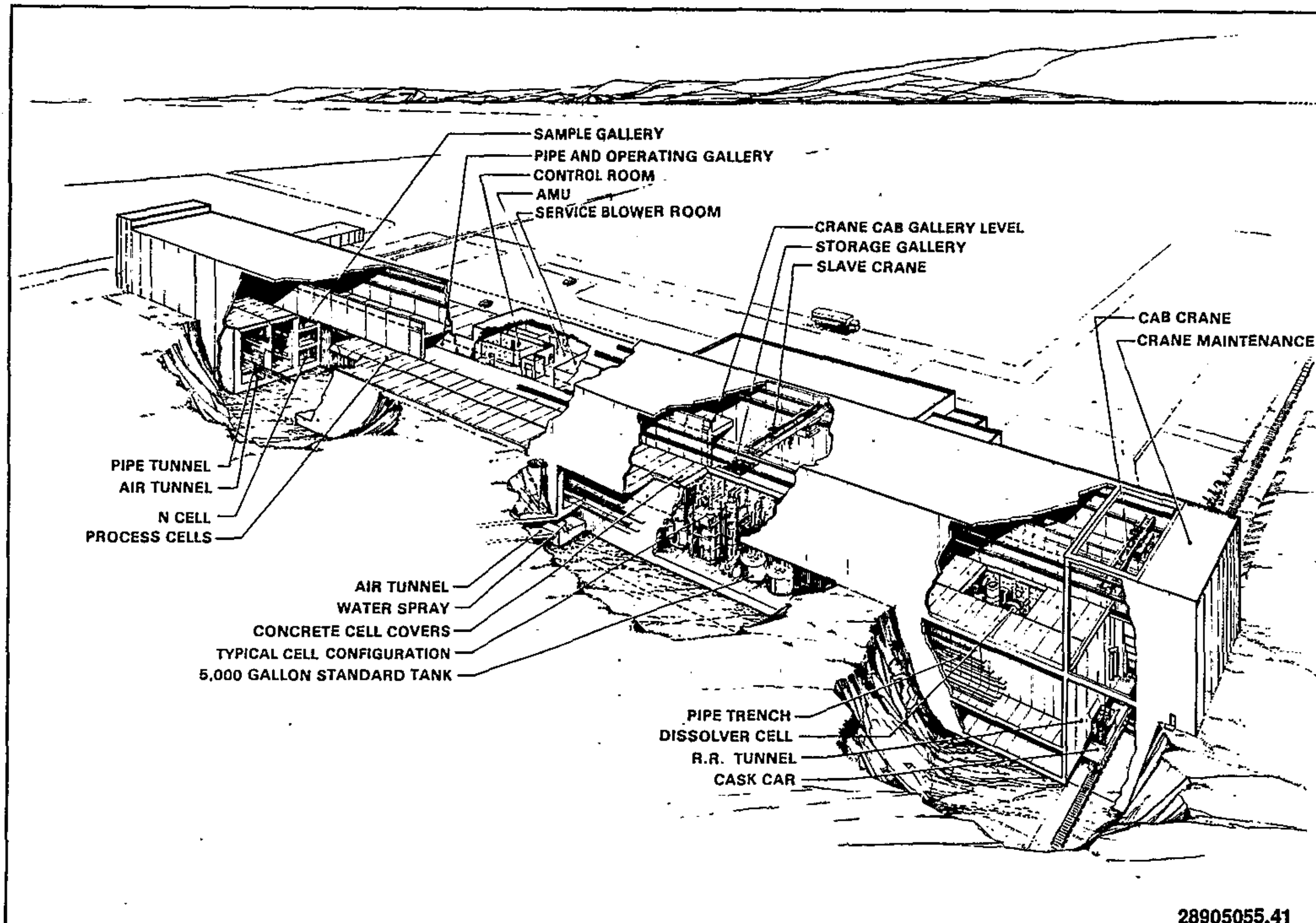
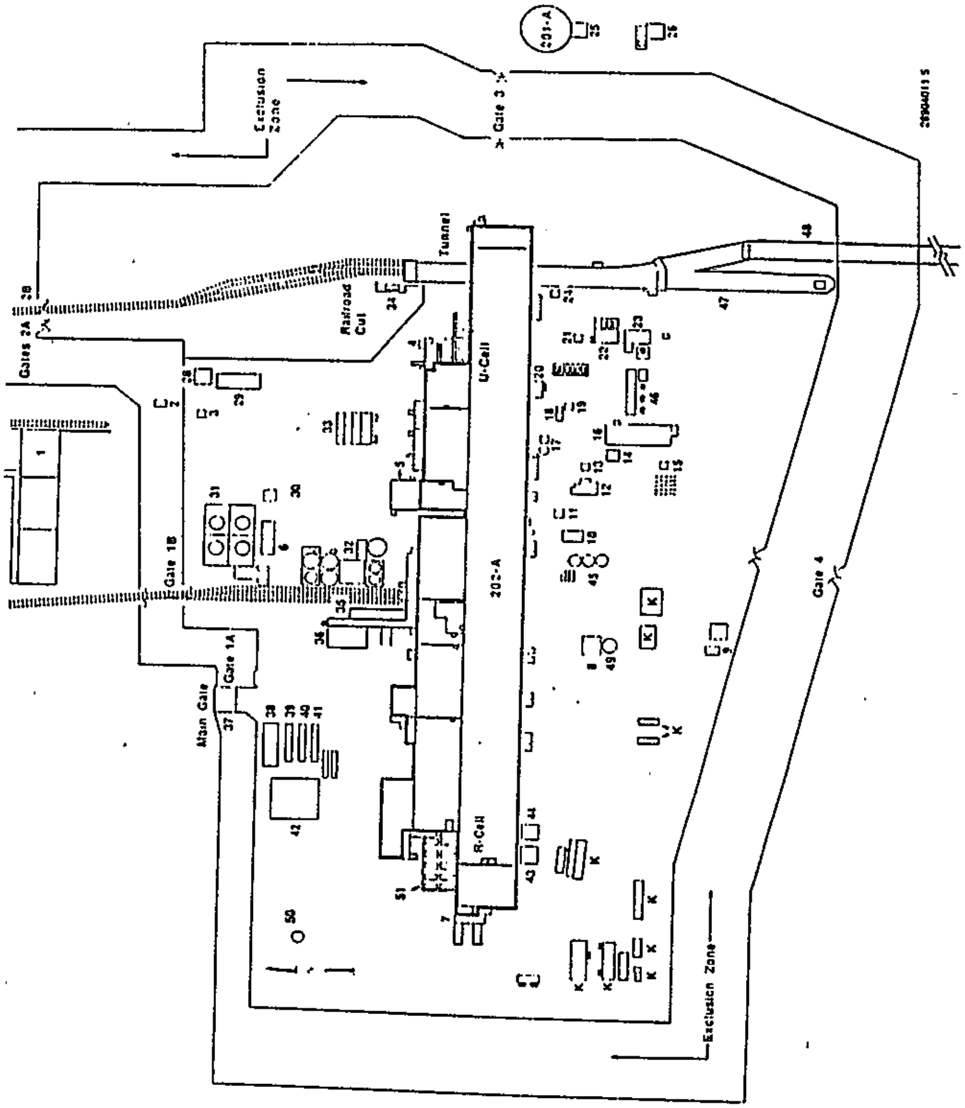


Figure 2-1. The 202-A Building.

Figure 2-2. The Plutonium-Uranium Extraction Plant Plot Plan.



1. 275-EA Warehouse
2. CSL PIT
3. 295-AC CSL (Chem. Sewer Line)
4. 206-A Fractionator
5. Laboratory Sample Receiving Dock
6. 203-A UNH Pump House Control Room
7. PR-Dock
8. 295-AB PDD (Process Distillate Discharge)
9. A-4 PIT PDD PIT
10. 213-A Reg Maint. Workshop
11. 291-AB Sample Shack
12. Shielded Valve PIT
13. 291-AC Instr. Shack
14. 291-AG Instr. Shack
15. 291-AJ Instr. Shack
16. 291-AE #4 Filter Bldg.
17. 295-AA SCD (Steam Condensate Discharge)
18. 291-AH Ammonia Off Gas Filter Bldg.
19. 291-AH Ammonia Off Gas Sampler Bldg.
20. 212-A Load Out
21. 294-A Instr. Shack
22. 293-A Dissolver Off Gas Bldg.
23. 292-AB Main Stack Bldg.
24. 295-A ASD (Ammonia Scrubber Discharge)
25. 201-A Pump PIT
26. 295-AD CWL (Cooling Water Line)
27. 8T2 Exhauster Area
28. 252-A
29. 281-A Emergency Generators
30. MO-332
31. 203-A Storage Area
32. 211-A Demineralizer Bldg.
33. MO-409 Laboratory Trailer
34. Railroad Storage Shed
35. 214 A, B, C, D
36. 2714-A
37. 2701-A Badge House
38. MO-035 Training Trailer
39. MO-707
40. 64-15323
41. 202A-T-1
42. MO-023 Engineering Trailer
43. 2711-A-1
44. 2712-A
45. Hydrogen Peroxide Tanks
46. 291-A Exhaust Fans
47. 218-E-14 Storage Tunnel
48. 218-E-15 Storage Tunnel
49. 216-A-5
50. 2901-A Water Tank
51. 276-A R Cell

K = Kaiser Related Facilities

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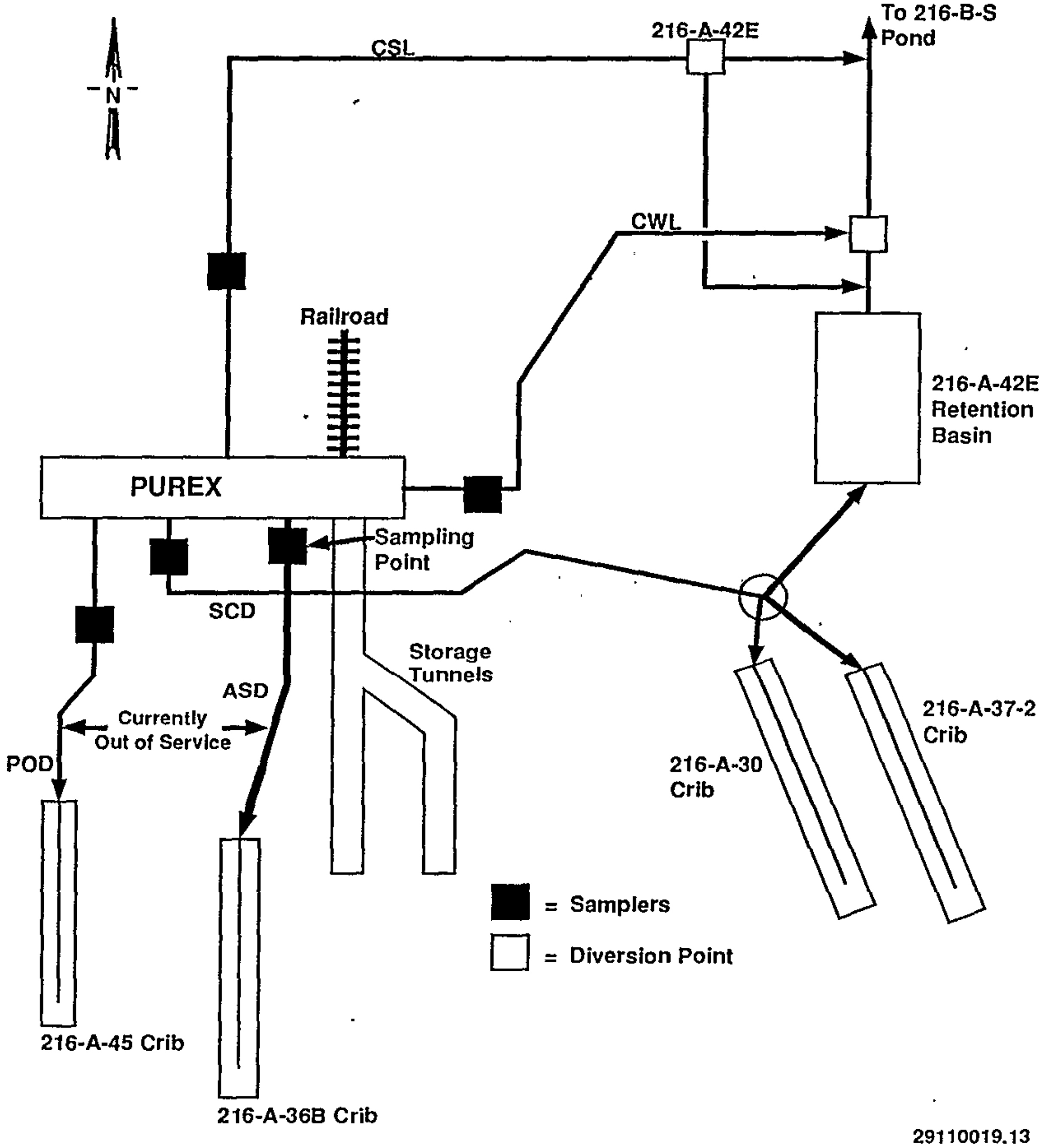
Figure 2-3. The Plutonium-Uranium Extraction Plant Liquid Effluents.



9 3 1 2 7 3 3 1 1 9 0

3.0 APPLICABLE REGULATIONS

Conditions and requirements for monitoring existing or potential releases of radioactive and other chemicals to the environment are contained in DOE orders and federal, state, and local laws and regulations. Table 3-2 gives a brief summary of the regulations and standards applicable to this FEMP.

3.1 U.S. DEPARTMENT OF ENERGY ORDERS

3.1.1 U.S. Department of Energy Order 5400.1

The DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988a), requires a written environmental monitoring plan for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials. The plan must include the rationale and design criteria for the monitoring program as well as describe the extent and frequency of the monitoring analysis. The plan also must contain QA requirements, program implementation procedures, directions for preparation and implementation of reports, and directions for identification and discussion of effluent monitoring and environmental surveillance.

The effluent monitoring portion of the plan must verify compliance with applicable regulations and DOE orders. It should also evaluate the effectiveness of treatment; identify potential environmental problems; evaluate the need for remedial action or mitigation measures; support permit revision and/or reissuance; and detect, characterize, and report unplanned releases.

3.1.2 U.S. Department of Energy Order 5400.5

The DOE Order 5400.5 (DOE 1990a) requires a monitoring plan that complies with the requirements of DOE Order 5400.1. Compliance with the requirements of DOE Order 5400.5 may be demonstrated based on calculations from information obtained from the monitoring and surveillance programs.

3.2 FEDERAL REGULATIONS

3.2.1 Environmental Protection Agency Regulations on National Emission Standards for Hazardous Air Pollutants 40 Code of Federal Regulations 61

Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," establishes exposure limits and sets out monitoring requirements. The exposure limits for members of the public from radionuclide emissions is an effective dose equivalent not to exceed 10 mrem/yr. Compliance with this standard is measured by calculating the highest effective dose equivalent where a person resides or abides using an EPA-approved method.

Emissions of radionuclides must be measured at all release points that have a potential to discharge radionuclides into the air in quantities that could cause an effective dose equivalent in excess of 1% of the standard. If the effective dose equivalent caused by all emissions is less than 1% of the standard (<0.1 mrem/yr) the facility is exempt from the EPA monitoring requirements. All radionuclides that could contribute greater than 10% of the potential effective dose equivalent for a release point (1 mrem/yr) shall be measured individually. With prior EPA approval, DOE may determine these emissions through alternative procedures. For other release points that have a potential to release radionuclides into the air, periodic confirmatory measurements shall be made to verify low emissions.

To determine whether a release point is subject to emission measurement requirements, it is necessary to evaluate the potential for radionuclide emissions for that release point. In evaluating the potential of a release point to discharge radionuclides into the air, the estimated radionuclide release rates shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facility operations were otherwise normal.

Subpart H also states that effluent streams shall be directly monitored continuously with an in-line detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance presented in American National Standards Institute (ANSI) N13.1 (ANSI 1969). The requirements for continuous sampling are applicable to batch processes when the unit is in operation. Periodic sampling (grab samples) may be used only with EPA's prior approval. Such approval may be granted in cases where continuous sampling is not practical and radionuclide emission rates are relatively constant. In such cases, grab samples shall be collected with sufficient frequency to provide a representative sample of the emissions.

3.2.2 Reportable Quantities 40 Code of Federal Regulations 302

The regulations in 40 CFR 302 (EPA 1989c) designate hazardous substances and identify reportable quantities and notification requirements for releases of these hazardous substances under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and the *Clean Water Act of 1977*.

Any unpermitted release of any of these designated hazardous substances must be reported. Therefore, if the possibility exists for a facility to release any of the designated substances, waste streams must be monitored for their presence and monitoring practices must be provided in a FEMP.

3.3 STATE REGULATIONS

3.3.1 Washington State Ambient Air Quality Standard and Emission Limits for Radionuclides

Although this standard for Washington (WAC 1986) establishes a 25 mrem/yr effective dose equivalent for public exposure to radionuclide emissions, facilities must comply with the most restrictive of federal, state, or local law. Therefore, the exposure limit that must be complied with is 10 mrem/yr; however, compliance is calculated at the point of maximum annual air concentration in an unrestricted area where any member of the public may be located (fence boundary).

3.3.2 Groundwater Protection

Radionuclides are defined as hazardous air pollutants, so they also will be construed to be hazardous in liquid effluent, without any specific listing of individual radionuclides as a hazardous substance under water pollution control laws.

The *Water Quality Standards for Groundwaters of the State of Washington* (WAC 1987b) protect groundwater to the level of drinking water standards. These standards limit exposures to gross alpha, gross beta, tritium, ^{90}Sr, and $^{226,228}Ra$ (Table 3-1). For radionuclides that are not specifically listed, exposures are limited by the federal standard of an effective dose equivalent not to exceed 4 mrem/yr.

3.3.3 Dangerous Waste Regulations

Any release of a dangerous waste or hazardous substance [as designated by Washington (State) Administrative Code (WAC) (WAC 1987a)] to the environment, except permitted releases, must be reported. Waste streams that have the potential to contain dangerous waste constituents must be monitored accordingly.

3.4 LOCAL REGULATIONS

3.4.1 Benton, Franklin, and Walla Walla Counties Air Pollution Control Authority

The local air pollution control authority has jurisdiction over all air emissions except radionuclide emissions in the Benton, Franklin, and Walla Walla county areas, including the Hanford Site. Currently, there are no local standards more restrictive than the previously mentioned state and federal limits.

Table 3-1. Groundwater Quality Criteria. (5 sheets)

Contaminant	Criterion	
I. Primary and Secondary Contaminants and Radionuclides		
A. Primary Contaminants		
Barium[a]	1.0	mg/L
Cadmium[a]	0.01	mg/L
Chromium[a]	0.05	mg/L
Lead[a]	0.05	mg/L
Mercury[a]	0.002	mg/L
Selenium[a]	0.01	mg/L
Silver[a]	0.05	mg/L
Fluoride	4	mg/L
Nitrate (as N)	10	mg/L
Endrin	0.0002	mg/L
Methoxychlor	0.1	mg/L
1,1,1-Trichloroethane	0.20	mg/L
2-4D	0.10	mg/L
2,4,5-TP Silvex	0.01	mg/L
Total Coliform Bacteria	1/100	mL
B. Secondary Contaminants		
Copper[a]	1.0	mg/L
Iron[a]	0.30	mg/L
Manganese[a]	0.05	mg/L
Zinc[a]	5.0	mg/L
Chloride	250	mg/L
Sulfate	250	mg/L
Total Dissolved Solids	500	mg/L
Foaming Agents	0.5	mg/L
pH	6.5-8.5	
Corrosivity	noncorrosive	

Table 3-1. Groundwater Quality Criteria. (5 sheets)

Contaminant		Criterion	
B. Secondary Contaminants (continued)			
	Color	15 color units	
	Odor	3 threshold odor units	
C. Radionuclides			
	Gross Alpha Particle Activity	15	pCi/L
	Gross Beta Particle Radioactivity		
	Gross Beta Activity	50	pCi/L
	Tritium	20,000	pCi/L
	^{90}Sr	8	pCi/L
	$^{226,228}Ra$	5	pCi/L
	^{226}Ra	3	pCi/L
II. Carcinogens			
	Acrylamide	0.02	µg/L
	Acrylonitrile	0.07	µg/L
	Aldrin	0.005	µg/L
	Aniline	14	µg/L
	Aramite	3	µg/L
	Arsenic[a]	0.05	µg/L
	Azobenzene	0.7	µg/L
	Benzene	1.0	µg/L
	Benzidine	0.0004	µg/L
	Benzo(a)pyrene	0.008	µg/L
	Benzotrichloride	0.007	µg/L
	Benzyl chloride	0.5	µg/L
	Bis(chloroethyl)ether	0.07	µg/L
	Bis(chloromethyl)ether	0.0004	µg/L
	Bis(2-ethylhexyl) phthalate	6.0	µg/L
	Bromodichloromethane	0.3	µg/L
	Bromoform	5	µg/L

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Table 3-1. Groundwater Quality Criteria. (5 sheets)

Contaminant		Criterion	
II. Carcinogens (continued)			
	Carbazole	5	μg/L
	Carbon tetrachloride	0.3	μg/L
	Chlordane	0.06	μg/L
	Chlorodibromomethane	0.5	μg/L
	Chloroform	7.0	μg/L
	4 Chloro-2-methyl aniline	0.1	μg/L
	4 Chloro-2methyl analine hydrochloride	0.2	μg/L
	o-Chloronitrobenzene	3	μg/L
	p-Chloronitrobenzene	5	μg/L
	Chlorthalonil	30	μg/L
	Diallate	1	μg/L
	DDT (includes DDE and DDD)	0.3	μg/L
	1,2 Dibromoethane	0.001	μg/L
	1,4 Dichlorobenzene	4	μg/L
	3,3' Dichlorobenzidine	0.2	μg/L
	1,1 Dichloroethane	1.0	μg/L
	1,2 Dichloroethane (ethylene chloride)	0.5	μg/L
	1,2 Dichloropropane	0.6	μg/L
	1,3 Dichloropropene	0.2	μg/L
	Dichlorvos	0.3	μg/L
	Dieldrin	0.005	μg/L
	3,3' Dimethoxybenzidine	6	μg/L
	3,3 Dimethylbenzidine	0.007	μg/L
	1,2 Dimethylhydrazine	60	μg/L
	2,4 Dinitrotoluene	0.1	μg/L
	2,6 Dinitrotoluene	0.1	μg/L
	1,4 Dioxane	7.0	μg/L
	1,2 Diphenylhydrazine	0.09	μg/L

Table 3-1. Groundwater Quality Criteria. (5 sheets)

Contaminant	Criterion	
II. Carcinogens (continued)		
Direct Black 38	0.009	µg/L
Direct Blue 6	0.009	µg/L
Direct Brown 95	0.009	µg/L
Epichlorohydrin	8	µg/L
Ethyl acrylate	2	µg/L
Ethylene dibromide	0.001	µg/L
Ethylene thiourea	2	µg/L
Folpet	20	µg/L
Furazolidone	0.02	µg/L
Furium	0.002	µg/L
Furmecyclox	3	µg/L
Heptachlor	0.02	µg/L
Heptachlor Epoxide	0.009	µg/L
Hexachlorobenzene	0.05	µg/L
Hexachlorocyclohexane (alpha)	0.001	µg/L
Hexachlorocyclohexane (technical)	0.05	µg/L
Hexachlorodibenzo-p-dioxin, mix	0.00001	µg/L
Hydrazine/Hydrazine sulfate	0.03	µg/L
Lindane	0.06	µg/L
2 Methoxy-5-nitroaniline	2	µg/L
2 Methylaniline	0.2	µg/L
2 Methylaniline hydrochloride	0.5	µg/L
4,4' Methylene bis(N,N'-dimethyl) aniline	2	µg/L
Methylene chloride (dichloromethane)	5	µg/L
Mirex	0.05	µg/L
Nitrofurazone	0.06	µg/L

Table 3-1. Groundwater Quality Criteria. (5 sheets)

Contaminant	Criterion	
II. Carcinogens (continued)		
N-Nitrosodiethanolamine	0.03	µg/L
N-Nitrosodiethylamine	0.0005	µg/L
N-Nitrosodimethlamine	0.002	µg/L
N-Nitrosodiphenylamine	17	µg/L
N-Nitroso-di-n-propylamine	0.01	µg/L
N-Nitrosopyrrolidine	0.04	µg/L
N-Nitroso-di-n-butylamine	0.02	µg/L
N-Nitroso-N-methylethylamine	0.004	µg/L
PAH	0.01	µg/L
PBBs	0.01	µg/L
PCBs	0.01	µg/L
o-Phenylenediamine	0.005	µg/L
Propylene oxide	0.01	µg/L
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.0000006	µg/L
Tetrachloroethylene (perchloroethylene)	0.8	µg/L
p,α,α,α-Tetrachlorotoluene	0.004	µg/L
2,4 Toluenediamine	0.002	µg/L
o-Toluidine	0.2	µg/L
Toxaphene	0.08	µg/L
Trichloroethylene	3	µg/L
2,4,6-Trichlorophenol	4	µg/L
Trimethyl phosphate	2	µg/L
Vinyl chloride	0.02	µg/L

mg/L = milligrams/liter.
mL = milliliter.
pCi/L = pico Curie/liter.
µg/L = micrograms/liter.

Table 3-2. Applicable Regulations and Standards. (2 sheets)

Agency/Originator	Regulation No.	HA	HL	RA	RL	Summary/Application
U.S. Department of Energy, (DOE) Washington, D.C.	DOE Order 5400.1, 1988 General Environmental Protection Program	X	X	X	X	Outlines effluent monitoring requirements
	DOE Order 5400.5, 1990 Radiation Protection of the Public and Environment			X	X	Protects public/environment from radiation associated with DOE operations
	DOE Order 5480.4, 1989 Environmental Protection, Safety, and Health Protection Standards	X	X	X	X	Sets requirements for the application of the mandatory environmental protection, safety, and health (ES&H) standards; lists reference ES&H standards
	DOE Order 5484.1, 1981 Environmental Protection, Safety, and Health Protection Information Reporting Requirements	X	X	X	X	Sets requirements for reporting information having environmental protection, safety and health protection significance
	DOE/EH-0173T, January 1991 Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance			X	X	Provides guidance for effluent sampling and monitoring.
U.S. Environmental Protection Agency, (EPA) Washington, D.C.	40 CFR 52.21 Prevention of Significant Deterioration (PSD) Requirements	X				Governs releases of criteria pollutants including NO_x, SO_2, and particulates
	40 CFR 61, 1991 National Emission Standards for Hazardous Air Pollutants	X		X		Sets national emission standards for hazardous air pollutants (NESHAP)
	Subpart A General Provisions	X				Regulates hazardous pollutants
	Subpart H National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities			X		Sets emissions standards/monitoring requirements for radionuclides
	40 CFR 122, 1983 EPA Administered Permit Programs: The National Pollutant Discharge Elimination System		X			Governs release of nonradioactive liquids
	40 CFR 141.16, 1989 Safe Drinking Water Act (National Interim Primary Drinking Water Regulations)				X	Sets maximum contaminant levels in public water systems
	40 CFR 261, 1989 Identification and Listing of Hazardous Waste		X			Identifies and lists hazardous wastes
	40 CFR 302.4, 1980 Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA): Designation, Reportable Quantities and Notification	X	X	X	X	Designates hazardous materials, reportable quantities, notification process

Table 3-2. Applicable Regulations and Standards. (2 sheets)

Agency/Originator	Regulation No.	HA	HL	RA	RL	Summary/Application
EPA (Cont'd)	40 CFR 355, 1987 Superfund Amendments and Reauthorization Act of 1986 (SARA): Emergency Planning and Notification	X	X			Identifies threshold planning quantities for extremely hazardous substances
American National Standards Institute, (ANSI) New York, New York	N 13.1 - 1969* Guidance to Sampling Airborne Radioactive Materials in Nuclear Facilities			X		Sets standards for effluent monitoring systems
	N 42.18*, 1974 Specification and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents			X	X	Recommendations for the selection of instrumentation for the monitoring of radioactive effluents
Washington State Department of Ecology, (Ecology) Olympia, Washington	WAC 173-216, 1989 State Waste Discharge Permit Program		X			Governs discharges to ground and surface waters
	WAC 173-220, 1988 National Pollutant Discharge Elimination system Permit		X		X	Governs wastewater discharges to navigable waterways; controls NPDES permit process
	WAC 173-240, 1990 Submission of Plans and Reports for Construction of Wastewater Facilities		X			Controls release of nonradioactive liquids
	WAC 173-303, 1989 Dangerous Waste Regulations		X			Regulates dangerous wastes; prohibits direct release to soil columns
	WAC 173-400, 1976 General Regulations for Air Pollution Sources	X		X		Sets emissions standards for hazardous air pollutants
	WAC 173-400-141, 1991 Prevention of Significant Deterioration (PSD)	X				Governs releases of criteria pollutants including NO_x, SO_2, and particulates
	WAC 173-400-105, 1991 Records, Monitoring, and Reporting	X				Governs recordkeeping and reporting
Washington State Department of Health, Olympia, Washington	WAC 246-247, 1991 Radiation Protection - Air Emmissions	X		X		Sets standards for registration, permitting, notification, new source, review, monitoring, and reports
Benton-Franklin Walla-Walla Counties Air Pollution Control Authority, (APCA) Richland, Washington	General Regulation 80-7, 1980	X				Regulates air quality

HA = hazardous airborne.
HL = hazardous liquid.
RA = radioactive airborne.
RL = radioactive liquid.
*Refers to standards that are referenced in the DOE and EPA regulations.

3.5 AIR EMISSIONS

The DOE Order 5400.5 (DOE 1990a) provides requirements for the monitoring of radioactive and nonradioactive airborne effluents from DOE facilities at the Hanford Site. This order states that DOE-controlled facilities must comply with 40 CFR 61 (EPA 1991c).

Additional EPA requirements on hazardous substances are contained in 40 CFR Part 302.4. This regulation provides information on reportable quantities of nonradioactive hazardous substances. Unlisted hazardous substances designated by 40 CFR Part 302.4 are regulated in accordance with the EPA toxicity of the contaminant.

In Washington State, airborne effluents are regulated by the *Washington Clean Air Act of 1967*, (WAC 173-400-075) (Ecology 1991b). General regulations for air pollution sources are presented in WAC 173-400, including emission standards for sources emitting hazardous air pollutants found in WAC 173-400-075.

The WAC 246-247, *Radiation Protection Air Emissions* (WDOH 1991), specifies new source review, notification, registration, and permitting requirements associated with any source of radioactive air emissions in Washington State, including those on the Hanford Site. One requirement listed in WAC 246-247 is the semiannual (twice yearly) reporting of emissions from each registered stack or vent on site. By agreement with the Washington State Department of Health, only annual reporting is required.

The WAC 173-480, *Ambient Radionuclides* (Ecology 1991b), defines maximum allowable levels for radionuclides in the ambient air and defines required levels of control of emissions. The regulation was last revised May 7, 1986, and enforced by Ecology.

While both the WAC 246-247 and 173-480 list outdated maximum EDE standards, each contains a caveat stating that any more stringent federal standards take precedence over the EDE standard specified by the WAC. Therefore, each effectively endorses the 10 mrem/yr EDE standard of 40 CFR 61, Subpart H.

Regulations, including DOE orders, state that DOE facilities must comply with the requirements set forth in the National Emission Standards for Hazardous Air Pollutants (NESHAP). Other regulations [e.g., 40 CFR 52, "Approval and Promulgation of Implementation Plans" (EPA 1991d); and DOE Orders 5400.1 (DOE 1988a), 5400.5 (DOE 1990a), DOE/EH-0173T (DOE 1991), and 5484.1 [DOE 1981)] state that DOE facilities must comply with the requirements set forth in the applicable *Clean Air Act of 1977* regulations. Applicable criteria in these regulations are discussed in Section 3.0 of this document.

3.6 LIQUID EFFLUENTS

Requirements limiting the exposure of the public to radioactive materials from DOE-controlled activities through the drinking water pathway are presented in DOE Order 5400.5, Chapter II, Paragraph 1.d. The radiological criteria of the public community drinking water standards of 40 CFR Part 141, "National Interim Primary Drinking Water Regulations" (EPA 1991e), are applicable to Steam and Water Utilities Operation 200 East and West Operations as the providers of potable water to the site under the *Safe Drinking Water Act of 1974*. It is the policy of DOE to provide an equivalent level of protection for all persons consuming from a drinking water supply operated by, or for, the DOE. These systems shall not cause any person consuming the water to receive an effective dose equivalent (EDE) greater than 4 mrem/yr, excluding naturally occurring radionuclides. In addition, DOE facility operators shall ensure that the liquid effluents from DOE activities shall not cause private or public drinking water systems downstream of the facility discharge to exceed the drinking water radiological limits of 40 CFR Part 141.

Depending on where a liquid effluent (wastewater) is discharged to, certain regulations apply. These regulations are implemented through issuance of permits by federal, state, and/or local agencies. It is the responsibility of the facility, through U.S. Department of Energy, Richland Field Office (RL), to apply for the permit appropriate to the effluent being discharged. Before applying for any permits, the applicant must know the sources of its wastewater discharges and where the wastewater is being discharged to. The following regulations apply based on where the wastewater is discharged:

1. The 40 CFR 261(4)(b)(6) (EPA 1991a) provides a hazardous waste exclusion for fly ash, bottom ash, and slag waste; and flue gas emissions control waste generated primarily from combustion of gas or other fossil fuel.

2. Washington State controls discharges to groundwater and surface water of the state, under WAC 173-216 (Ecology 1991a), and issues permits for such discharges. A permit of this type would be necessary for any discharges to land that could infiltrate to groundwater.

Each type of discharge permit identified will typically contain discharge limitations and monitoring requirements. However, the limitations and monitoring requirements will vary depending on the source and type of wastewater being discharged. For instance, discharges to a publicly owned treatment works will be subject to pretreatment standards based on the production process that generates the wastewater for those processes categorized by the EPA. Categorical processes are identified in 40 CFR 401-471 (EPA 1991e). Specific limitations, monitoring, and reporting requirements have been promulgated for each categorical process. In addition to EPA's requirements, the state and local sewerage agencies may impose additional limitations, monitoring, and reporting requirements. Discharges to a navigable waterway also will be subject to certain standards based on the industrial process that generated the wastewater; certain additional limitations are typically imposed in the National Pollutant Discharge Elimination System permit. In all cases, the specific pollutants to be monitored and the frequency of monitoring and reporting will be based on the applicable regulations and the language of the permit.

4.0 IDENTIFICATION/CHARACTERIZATION OF EFFLUENT STREAMS

This chapter addresses the chemical and radiological composition of PUREX effluents. A description of the gaseous effluents is followed by a brief discussion of their routine and upset operating conditions. Water effluents are similarly described.

4.1 IDENTIFICATION/CHARACTERIZATION OF SOURCE TERMS CONTRIBUTING TO EACH AIR EFFLUENT STREAM

PUREX has 16 sources of air effluents with a potential for contamination. There are 10 major effluent streams and 6 of the effluents are minor. Characterization of the effluents is based upon averaged and normalized second, third, and forth quarter 1990 preliminary concentration and flow data. These are representative of standby conditions.

4.1.1 Descriptions

The characterizations that follow are taken from the *Effluent Monitoring Plan PUREX Gaseous Effluents* (WHC 1988a). Stack locations are shown in Figure 4-1; their heights and diameters are summarized in Table 4-2.

291-A-1--Canyon Exhaust Stack

The point of discharge is a 61 m (200 ft) tall stack, located south of the PUREX Plant. It typically has a flow rate of between 28 and 61 m^3/s (60,000 and 130,000 ft^3/min). The average flow rate is 57 m^3/s (120,000 ft^3/min). For the last three quarters of 1990, the exhaust typically contained 3.3×10^{-10} μCi/mL radioactivity. The average value for individual radionuclides are shown in Table 4-1.

During 1985 and 1986 the annual releases of NO_x from the main stack were 168 and 147 metric tons (185 and 162 tons), respectively. This was well below the 385 metric tons (424 tons) permitted by the Prevention of Significant Deterioration (PSD) permit. No NO_x is released during standby.

296-A-1--Product Removal Room Exhaust

The point of discharge for the PR room exhaust is stack 296-A-1, located on the north side near the northwest corner of the 202-A Building.

The 296-A-1 stack has an average flow of 2.0 m^3/s (4,300 ft^3/min). The range of flow is 1.9 to 3.6 m^3/s (4,000 to 7,600 ft^3/min). The exhaust contained 1.4×10^{-14} μCi/mL of radioactivity based on data from the last three quarters of 1990.

296-A-2--West Sample Gallery Hood Exhaust

The 296-A-2 stack exhausts sampler hoods from the west end of the PUREX sample gallery. It is located at the southwest corner of the 202-A Building.

The 296-A-2 stack has an average flow of 1.6 m^3/s (3,400 ft^3/min). The range of flow is 1.4 to 2.2 m^3/s (3,000 to 4,600 ft^3/min). The exhaust contained 9.5 x 10^{-16} $\mu Ci/mL$ of radioactivity based on data from the last three quarters of 1990.

296-A-3--East Sample Hood Exhaust

The 296-A-3 stack exhausts sampler hoods from the east end of the PUREX sample gallery. It is located at the northeast corner of the 202-A Building.

Normal flow for this stack is 1.6 m^3/s (3,400 ft^3/min), while the range is 1.6 to 2.2 m^3/s (3,500 to 4,600 ft^3/min). The average activity was not distinguishable from background and, therefore, the dose contribution is indeterminant. A single peak analysis assumed for an entire year resulted in an EDE of 1 x 10^{-6} mrem/yr or unmitigated 1 x 10^{-3} mrem/yr. Contribution by this stack is negligible during standby.

296-A-5A and 296-A-5B--West and East Analytical Laboratory Exhausts

Stacks 296-A-5A and 296-A-5B alternate weekly in exhausting the PUREX analytical laboratory. The stacks are located on the north side of the 202-A Building above the analytical laboratory.

The flow through stacks 296-A-5A and 296-A-5B nominally range from 7.1 to 10.8 m^3/s (15,000 to 23,000 ft^3/min), respectively. Their average flow rate is 7.6 m^3/s (16,000 ft^3/min). The exhaust from stack 296-A-5A had an activity of 9.7 x 10^{-16} $\mu Ci/mL$, and stack 296-A-5B had an activity of 1.0 x 10^{-15} $\mu Ci/mL$ based on the last three quarters of 1990. The combined average is 1.0 x 10^{-15} $\mu Ci/mL$.

296-A-6--East Sample Gallery and U-Cell Stack

The 296-A-6 stack is located on the north side of the 202-A Building near the east corner. The stack extends 3 m (10 ft) above the top of the building. Its top is 23 m (74 ft) above grade level.

The 296-A-6 stack exhausts the east end of the sample gallery and U-cell (nitric acid recovery cell).

The 296-A-6 stack has an average flow of 6.6 m^3/s (14,000 ft^3/min). The range of flow is 6.1 to 9.1 m^3/s (13,000 to 19,200 ft^3/min). The exhaust contained 1.0 x 10^{-15} $\mu Ci/mL$ of radioactivity based on data from the last three quarters of 1990.

296-A-7--West Sample Gallery and R-Cell Exhaust

The 296-A-7 stack is located on the west wall of the 202-A Building near the southwest corner. The top of the stack is 23 m (74 ft) above grade [3 m (10 ft) above the top of the building]. It exhausts the west half of the sample gallery and R-cell (second cycle solvent treatment).

The 296-A-7 stack has an average flow of 7.6 m^3/s (16,000 ft^3/min), with a range of 6.6 to 10.2 m^3/s (14,000 to 21,600 ft^3/min). The exhaust contained 2.3×10^{-15} $\mu Ci/mL$ of radioactivity based on data from the last three quarters of 1990.

296-A-8--White Room Exhaust

The 296-A-8 stack is located at the northwest corner of the 202-A Building. It extends to 10 m (34 ft) above grade level. This stack exhausts the west end of the P&O gallery.

The 296-A-8 stack has a nominal flow of 6.1 m^3/s (13,000 ft^3/min). The range of flow is 5.7 to 7.6 m^3/s (12,000 to 16,200 ft^3/min). The exhaust contained 1.1×10^{-15} $\mu Ci/mL$ of radioactivity based on data from the last three quarters of 1990.

296-A-10--Storage Tunnel No. 2 Exhaust

The 296-A-10 stack is located about 640 m (2,100 ft) south of the 202-A Building near the east end. It is 6 m (20 ft) high. This stack exhausts the used equipment storage tunnel.

The 296-A-10 stack has an average flow of 1.6 m^3/m (3,500 ft^3/min). The exhaust contained 1.7×10^{-14} $\mu Ci/mL$ of radioactivity based on data from the last three quarters of 1990.

296-A-14--Backup Facility Exhaust (Building 293-A)

The 293-A Building exhaust fan is located on the mezzanine roof. The stack rises 3 m (10 ft) above the top of the 293-A Building for a stack height of 7.47 m (24 ft 6 in.).

The 296-A-14 stack exhausts the 293-A Building, which contains two absorption columns that recover nitric acid from the dissolver offgases. The dissolvers are not in operation.

Flow through the 296-A-14 stack is a nominal 2 m^3/s (4,000 ft^3/min). The exhaust contained 5.7×10^{-15} $\mu Ci/mL$ of radioactivity based on data from the last three quarters of 1990.

296-A-24--Ammonia Offgas Exhaust

This stack is not used during standby and is no longer a gaseous effluent source.

The 296-A-24 stack is located about 60 m (200 ft) south of the PUREX Building. The top is 24 m (80 ft) above grade level.

The ammonia bearing gases formed in D-, E-, and F-cells during the decladding of fuel elements were isolated from other vent systems to prevent the formation of ammonium nitrate, which can plug ventilation filters. The gases were heated, filtered, and exhausted through the ammonia stack. Decladding operations and operation of stack 296-A-24 have ceased with the shutdown of the PUREX Plant.

During operations, the 296-A-24 stack has a nominal flow rate of 0.5 m^3/s (1,000 ft^3/min). The exhaust contained between <3.5 x 10^{-15} and 7.8 x 10^{-14} $\mu Ci/mL$ of total alpha and 2 x 10^{-14} and 1 x 10^{-9} $\mu Ci/mL$ of total beta radioactivity.

EF-3-5 Through EF-3-10--Wall Exhausters, Pipe and Operating Gallery

The five P&O gallery wall exhausts are 1.02 m x 1.02 m (40 in. x 40 in.) square openings fitted with gravity dampers. A total of six openings are located along the top of the P&O gallery north wall at approximately 6.8 m (22 ft 3 in.) above grade level. Five of the openings are fitted with exhaust fans to remove air from the P&O gallery. Three of the exhausters (EF-3-5, EF-3-6, and EF-3-8) are inactive (including the fanless opening). An engineering study was completed with work ongoing to seal the dampers closed.

Radioactivity is not normally present in the P&O gallery; however, there are service connections to many of the process vessels in the canyon. In the event that a line in the gallery is broken, or loosened for replacement or repair, and the associated canyon vessel is pressurized, solution could blow back from the vessel to the gallery.

The initial concept was that the P&O gallery wall exhausters would run continuously. However, the upgrade of the white room exhaust system (296-A-8 stack) provided sufficient capacity to exhaust the entire P&O gallery via that stack. The wall exhausters discharge minor effluents.

The flow from the exhausters EF-3-5 through EF-3-9 ranges from 0 to 3.5 m^3/s (0 to 7,500 ft^3/min). The monthly total alpha radioactivity values for the exhausters ranged from <3.5 x 10^{-14} to 2.4 x 10^{-14} $\mu Ci/mL$. The monthly total beta radioactivity values ranged from a low of <1.2 x 10^{-14} to a high of 9.3 x 10^{-12} $\mu Ci/mL$.

Aqueous Makeup Roof Exhauster System Description

The basement, second floor, and third floor AMUs are exhausted into vertical ducts that lead to the roof of the 202-A Building. Motive force is supplied by an exhaust fan which discharges 7.6 m^3/s (16,000 ft^3/min) of untreated unfiltered air to the atmosphere. In as much as this is a nonradioactive area where aqueous solutions of solid or liquid chemicals are prepared, no regulated materials of a gaseous nature are emitted.

The AMU exhaust is a minor effluent.

4.1.2 Routine Operating Conditions

The ventilation systems will continue to exhaust the same areas of the PUREX Plant as described in Chapter 2.0 and Section 4.1.1. However, since the PUREX Plant has been shut down (i.e., no processing), the source radionuclides that might be vented have been reduced, and the effluent concentrations are expected to be at or below the low end of the previously given ranges.

4.1.3 Upset Operating Conditions

The *Effluent Monitoring Plan for PUREX Gaseous Effluents* (WHC 1988a), describes upset conditions for each stack. However, these are based upon the PUREX process being active in the plant and are no longer applicable. In the shutdown mode, upset operating conditions could involve failure of a single engineered barrier, which is taken to be failure of the HEPA filtration. Filtration is provided for all of the gas streams except the five wall exhausters and the AMU roof exhauster. A HEPA filter failure is modeled in Section 4.1.4.4.

4.1.4 Dispersion Modeling

Only radiological emissions are present in the PUREX air effluent during the standby mode of operation. CAP-88 computer code calculates dose commitments that result from the air transport of radionuclides released from the effluent discharge points above the PUREX Plant. CAP-88 is approved by the EPA for demonstrating compliance with the NESHAPs (EPA 1989a) standard for radiological releases. CAP-88 computes the radiation exposure to the maximally exposed individual (MEI) via the ingestion, inhalation, air-immersion (exposure resulting from being inside the plume of radiation), and groundshine (exposure resulting from deposited radioactive particles) pathways. CAP-88 incorporates dose conversion factors from the International Commission on Radiological Protection (ICRP) 26/30 methodology (DOE 1988). Resulting doses are a 50-yr committed effective dose equivalent. The magnitude of exposure via any of the aforementioned pathways is strongly related to the distance between the source and receptor.

CAP-88 uses a Gaussian plume methodology for dispersing air contaminants to downwind locations. Because of the low temperatures of the PUREX stacks, CAP-88 calculates plume rise solely from stack exhaust momentum. During transport, the plume undergoes a reduction in air concentration, not only through dispersion, but also from plume depletion processes. These processes include radioactive decay, precipitation scavenging, and dry deposition. Because of the long half-lives of the radionuclides released and the relatively dry climate in eastern Washington State, only the dry deposition removal process has an appreciable effect on the resulting downwind air concentration. For this analysis, a dry deposition velocity of 0.0018 m/s was used for all radionuclide particulates.

A total of 11 air effluent stacks contribute nearly all of the airborne radionuclide releases from the PUREX Plant (WHC 1988a). Each stack possesses its own unique stack characteristics, including stack height above the ground, stack diameter, and exhaust velocity or flow rate. Stack characteristics are used to assess the plume rise and determine the final height of release of the plume. Air effluents are released at room temperature; as such, plume rises are not thermally driven. Table 4-2 summarizes the characteristics of the 11 PUREX exhaust stacks.

Historically, the MEI was located at the facility boundary where it was hypothetically possible for a person to continuously reside and raise all food consumed. In December 1989, the EPA promulgated new regulations (EPA 1989a) that redefined the MEI to be the maximum exposure to a member of the public at an actual school, business, or residence. In this analysis, boundary locations are used for MEI distances. As such, calculated doses will, in general, be greater than those for actual resident/worker locations at greater distances and will represent a conservatively high estimate of the MEI dose.

The MEI was found to occur in the east wind direction sector from the PUREX Plant at a distance of 18.05 km (WHC 1988a). No additional distance beyond the Hanford Site boundary can be credited to the MEI exposure location for PUREX releases as a result of the new EPA regulations. Table 4-3 shows the distance from PUREX to the MEI/boundary locations used in assessing the MEI location.

4.1.4.1 Meteorological Data. A joint frequency distribution of wind direction, wind speed class, and Pasquill stability class was used to calculate wind data for the CAP-88 code. The wind data was measured at the 10 m level of the Hanford Site meteorological tower located between the 200 East and 200 West Areas. Although all 11 stacks of the 10 sources analyzed are higher than the 10 m measurement, the 10 m data is still applicable because the plume ultimately disperses near ground levels where the MEI is located. In addition, the 10 m wind is "slower" than the prevailing winds at stack height and, therefore, yields a conservatively higher dose.

The data were used to calculate reciprocal and true averaged wind speeds, frequency of occurrence of wind direction, and frequency of occurrence of wind stability class in each of 16 wind direction sectors. Table 4-4 shows some of the most general wind rose data calculated from the joint frequency distribution.

Additional meteorological data used by CAP-88 included the average mixing height, which limits the extent of vertical dispersion. An average annual value of 1,120 m was calculated as the average of the winter and summer mixing heights of 240 m and 2,000 m.

4.1.4.2 Radioisotope Screening.

CHI/Q Values. The MEI location was analyzed using 16 MEI exposure distances (Table 4-5) and the meteorological data described in Section 4.1.4.1. The CAP-88 code calculated a ground-level CHI/Q value (air concentration per unit source release) in each of the 16 wind direction sectors. The greatest CHI/Q value at the MEI distance, calculated for each sector, represents the MEI location. Table 4-5 shows the CHI/Q values calculated for the 16 sectors around the PUREX Plant. A maximum CHI/Q value of 3.2×10^{-8} s/m^3 was calculated to occur in the east sector at a distance of 18.05 km from the PUREX Plant.

Radionuclide Screening Analysis. Very small quantities of many different radioactive isotopes are released from PUREX during the standby mode. To reduce the number of radioisotopes analyzed, only releases that yielded the greatest radiation doses at the MEI receptor location were entered into the CAP-88 code. The radionuclides were screened for potential dose contribution via multiple exposure pathways. The specific radionuclide doses used in the screening process were calculated as the product of the released amount of the radionuclide and the dose conversion factor. The resulting products were compared with and concluded to be proportional to the CAP-88 calculated doses. Radionuclides screened for significant contribution in each pathway were specifically flagged for dose assessment.

Table 4-6 summarizes the radionuclide screening analysis. The "Prod 1" column of the table displays the product of the inhalation dose conversion factors and radionuclide releases. Similarly, the "Prod 2" and "Prod 3" columns display the products of the ingestion and air-immersion pathways with the radionuclide releases, respectively. Table 4-6 shows that ^{90}Sr, ^{239}Pu, and ^{241}Am comprise most of the inhalation dose. All radionuclides within two orders of magnitude of the maximum "Prod 1" column are carried into the final CAP-88 analysis for the inhalation dose. The total inventory of radionuclides are screened for significant contribution to the ingestion and submersion pathways in a similar manner.

The groundshine pathway is omitted from the dose analysis because the gravitational settling velocity of the released particles is zero. Particulate matter emerging from the HEPA filters is too small to be significantly affected by gravity. Consequently, the radionuclide surface deposition at downwind locations is attributable only to dry deposition velocity and is exceedingly small. The screening for significant radionuclides was done for the main stack only because releases from the other stacks contain similar proportional quantities of radionuclides.

4.1.4.3 Routine Release Dose Assessment. During normal operations in standby mode at PUREX, only small quantities of radionuclides are released from the exhaust stacks (Table 4-7). An MEI was found to occur in the east sector at a distance of 18.05 km downwind from the PUREX Plant. This position corresponds to the boundary of the Hanford Site reservation on the east side of the Columbia River. Several private residences are located at this point.

An effective dose equivalent of 0.014 mrem was assessed for the MEI location as a result of releases from all 10 operating PUREX stacks. This total dose is well below the EPA annual dose criterion (EPA 1989a) of 10 mrem to the MEI via the air pathway. This total dose is intended to be used for total-facility, emission-compliance purposes but not for monitoring requirements.

Table 4-8 summarizes the individual stack contributions to the MEI dose from each PUREX stack. As noted in Table 4-8, any stack with an individual dose greater than the EPA standard of 0.1 mrem/yr (1% of 10 mrem/yr) is required to have "continuous radiation monitoring." This continuous radiation monitoring is an EPA designation but is fully met by continuous sampling with periodic analysis. The greatest dose from any PUREX stack effluent is from the main stack (291-A-1), which independently contributes a dose of 0.014 mrem to the MEI. This dose is well below the 0.1 mrem annual dose standard.

The MEI dose resulted primarily from the ingestion and inhalation of ^{129}I that originated from the canyon exhaust stack (291-A-1) at PUREX. Because all stack doses are below the 0.1 mrem annual dose standard, specific radionuclide analysis is not required.

4.1.4.4 Upset Release Dose Assessment. Applicable EPA regulations (EPA 1989a) require that a dose to the MEI be calculated from an unmitigated release. An unmitigated release occurs in the case of an upset in which all air pollution control equipment fails (or is considered to have been removed). At PUREX, this means a dose that results from the unfiltered flow from each of the stack effluents described in Table 4-9. Monitoring of the effluent stream is not made prior to the HEPA filters. Consequently, the increase in effluent radionuclides due to filter removal is based on an evaluation of filter efficiencies and the particulate removal processes.

Stack 291-A-1 (the main stack) and stack 296-A-1 exhaust through several stages of HEPA filters. The remaining stacks use a single stage of HEPA filtration. A conservative increase in particulate effluent due to filter removal is 3.0×10^3 for those stacks. With concurrence from EPA, this single factor was used for particulate removal efficiency for all stacks.

The iodine emission control equipment, the silver reactors of the dissolver offgas system, are neither needed nor in service during standby operation; so there is no increase in radioactive iodine emissions because of bypass of pollution control equipment. Its unmitigated release factor is 1.0. There is no effective pollution control equipment for the other volatile emissions (tritium and ^{14}C), so their unmitigated release factors are also 1.0.

The dose calculated for the MEI is directly proportional to the amount of radioactive material released. Because all particulate releases are increased by the same amount in a given stack, the resulting unmitigated dose is the MEI dose increased by a unmitigated release factor of 3.0×10^3 for particulates and 1.0 for volatiles. Volatiles are assumed to exist as vapor and are not filterable.

Table 4-9 summarizes the contributions to the unmitigated MEI dose from each PUREX stack during standby. As noted in Table 4-9, any stack with an individual annual dose greater than the EPA standard of 0.1 mrem/yr is required to have a minimum of continuous sampling and subsequent analysis. The main stack and stack 296-A-1 both have unmitigated dose consequences that are in excess of this standard.

The unmitigated MEI dose resulted primarily from the ingestion and inhalation of ^{239}Pu originating from the main stack at PUREX. Inhalation of ^{90}Sr also contributes a significant percentage of the dose. The unmitigated MEI dose from stack 296-A-1 resulted primarily from the ingestion and inhalation of ^{241}Am and ^{239}Pu in essentially equal contributions. Table 4-10 summarizes the most significant radionuclides and their dose contributions to the MEI. Any radionuclide that contributes 10% of the dose from a release point which could exceed the EPA annual dose standard of 0.1 mrem must be monitored selectively at the exhaust point. Two radionuclides from the main stack and two radionuclides from the 296-A-1 stack have individual radionuclides that exceed this standard and will require selective air monitoring. Air monitoring requirements are discussed in more detail in Section 7.1.

4.2 IDENTIFICATION/CHARACTERIZATION OF SOURCE TERMS CONTRIBUTING TO EACH LIQUID EFFLUENT STREAM

The following sections describe the only remaining liquid effluent from the PUREX Plant, the CSL.

4.2.1 Descriptions

PUREX water effluents are described in detail in a series of stream-specific reports (WHC 1990a), which were written to reflect PUREX in its operating mode. The points of discharge and compositions for the CWL, SCD, and CSL are given in Table 4-11. (After June 1992, there will be only one stream, the CSL. However, some of the contributors will be rerouted to the CSL.) The composition data given in Table 4-11 are for the upper limits of the 90% confidence interval as given in the stream-specific reports. These compositions are higher than anticipated for standby conditions. Table 4-11 also indicates the average flow rate, point of discharge, and stream-specific report number for each stream.

4.2.2 Routine Operating Conditions

The CSL collects waste water from the nonradiologically controlled service areas of the PUREX Plant (the 202-A Building and supporting facilities), as well as steam condensate and cooling water from the vacuum fractionator. Most of these streams are essentially clean, consisting of steam condensate from ventilation air heaters, water cooler drains, shower drains, and assorted floor drains. The floor drains, especially in the P&O gallery, AMU, and 211-A Building, have a potential for chemical contamination.

The water in the streams which contribute to the CSL originates in three utilities provided to the PUREX plant by the powerhouse: raw water, sanitary water, and steam. During operation, the PUREX plant generates a fourth utility, demineralized water, which contributes slightly to the CSL.

Raw water is untreated water pumped from the Columbia River. It is used in cooling process vessels and as a source for other water utility streams. Raw water may contribute some corrosion products from the piping used in its transport.

Sanitary water (potable water) is produced from raw water by a two stage process. First, particulates are settled and removed, with the help of aluminum sulfate (alum). Second, bacteria and organic debris are oxidized by the addition of chlorine. Consequently, sanitary water contains elevated levels of aluminum, sulfate, chloride, hypochlorite, carbonate, and organic chlorides such as trichloromethane (chloroform).

The powerhouse produces steam by boiling steam make-up water, derived from sanitary water. The steam make-up water is first softened to replace calcium and magnesium ions with sodium ions. Additionally, hypochlorite is reduced to chloride, and corrosion inhibitors are added. Of these corrosion inhibitors, Filmeen* contains volatile substances which can be carried over into the steam. According to the manufacturer, Filmeen contains both fatty amines and organic acids. The material safety data sheet (MSDS) for this product does not list chemical ingredients. It does, however, state that the product does not contain EPA hazardous constituents.

The following contribute to the PUREX Plant CSL waste stream.

- Floor drains in the 202-A P&O gallery (only if diverted to PUREX Plant CSL from their normal routing to storage tanks in U-cell and to the F-cell sump). The routing of the P&O Gallery floor drains to the CSL is a minor modification to the normal configuration used for housekeeping. This modification adds 200 East Area raw water and dirt that has been tracked into the building from outside.

- The 618-1 and 618-2 flash tanks contribute spray water and steam condensate from steam traps located in the P&O gallery and AMU. The 618-1 flash tank is outside the 202-A Building near the east end. The 618-2 flash tank is in the AMU.

- Cooling water from the three fractionator condensers and steam condensate from the fractionator reboiler in the 206-A Building. When the PUREX plant is processing, this contributor accounts for most of the CSL flow. During standby, there is normally no effluent from this contributor.

- The sink drain from the battery room, and the floor and sink drains from the instrument shop and maintenance shop in the 202-A Building. Westinghouse Hanford has an aggressive program to prevent the improper disposal of dangerous wastes generated in these areas.

- Drains from nonradioactive clothing change rooms in the PUREX Plant laboratory (202-A Building).

- Shower drains from the two shower rooms. In addition to sanitary water, these drains contribute dirt washed from personnel and surfactants.

- Air scrubber effluent form the ventilation air supply systems in the 202-A Building.

- Laboratory and process water stills steam condensate and still bottoms in the 202-A Building.

- Floor drains from the air compressor, process blower, and service blower rooms in the 202-A Building.

- Cooling water and condensate from the air compressors. This cooling water is normally provided by the sanitary water system. Raw water can also be used.

*Filmeen is a trademark of Dearborn, a division of W. R. Grace Co.

- Steam condensates from the blower rooms in the 202-A Building.

- Overflows from the two demineralized water storage tanks (Tk-223 in the 202-A Building and Tk-30 in the 211-A Area).

- Floor drains from the 211-A Pumphouse. These drains flow through the B-669 pH neutralization system before entering the CSL. See Section 2.3.1.3 for administrative controls used on the 202-A Site.

- Sumps from the 203-A Area, via TK-P1, which are used to collect sump waste, mostly rainwater and steam condensate from heating coils. Standard plant operating procedures ensure that chemical spills and radioactive liquids are not routed to the CSL, but are ultimately discharged to underground storage.

- Office area heater condensate from the 202-A Building and the 271-AB Building.

- Raw water [about 113.5 L/min (30 gal/min)] used to continuously flush the CSL header line from its origin near the northwest corner of the PUREX Plant complex.

- Overflow from the emergency water supply tank (TK-2901A). The sanitary water feed [approximately 95 L/min (25 gal/min)] to this tank is left running to maintain residual chlorine levels, ensure that the tank is full, and (in winter) provide protection against freezing.

There is a remote possibility for any of the chemicals handled within the AMU in the 202-A Building to escape from established spill barriers and enter the PUREX Plant CSL. See Table 4-14 for a list of chemicals used in the PUREX Plant.

Project CK0081 installed an extensive chemical collection and reuse system in the AMU in 1987. Only the sink drains, the electric water cooler drain, and the overflows and drains from the sugar tank and demineralized water tank feed directly into the CSL header. The floor drains can be routed through valves into the PUREX Plant CSL header, but normally flow into a catch tank. The remaining overflows and drains flow into a system of catch tanks to collect the chemicals for reuse. (The overflow lines from the catch tanks do, however, feed into the CSL header.)

The collection pipes merge into a common discharge line on the north side of the Plant.

Data compiled in the CSL stream-specific report were obtained during ion exchanger regeneration (5 samples) and during routine operation (6 samples). The evaluation contained in the stream-specific report indicated that the CSL did not contain any dangerous wastes, as defined in WAC 173-303-070 (WAC 1987a). A full discussion of the chemicals detected in the samples, the reported concentrations of these chemicals, analytical detection limits, and the pertinent regulatory limits is contained in the stream-specific report (WHC 1990a, Addendum 2).

The ventilation scrub water contributors are produced by the wet scrubbing process for ventilation air. Air from outside the 202-A Building is brought in contact with sanitary water to remove dust from the air and to cool the air. In the past, several microbiocides were added to the water in the air scrubbers: Dearcide 730* [198 g (7 avoirdupois oz.)/mo/scrubber], Dearcide 722+[0.3 L (10 fluid oz.)/mo/scrubber], and Dearcide 717* [0.3 L (10 fluid oz.) /mo/scrubber]. These microbiocides were added to the air scrubber to prevent the growth of harmful microorganisms in the scrub water. These additives increase the chloride concentration and also add tin to the system. The flow of ventilation scrub water is estimated to range from 0.2 to 3.0 L/min (0.05 to 0.8 gal/min), with an average of 0.8 L/min (0.2 gal/min).

There are three water demineralizers in the 211-A Building that contribute water to the CSL intermittently during regeneration. The demineralizers convert sanitary water to the pure demineralized water required by the PUREX process. Each consists of two ion-exchange columns: one for cations and one for anions. The regeneration process uses sulfuric acid and sodium hydroxide, and releases the contaminants that the demineralizer had removed from the sanitary water feed. The demineralizers are not anticipated to be used during standby.

Project B-669 (recently installed) provides a three-chamber pH control system for the effluent from the 211-A Building. This effluent is composed of leakage from pipes and pumps in the building, seal water drainage from certain pumps, and demineralizer regeneration waste. In addition to the cations and anions removed from the sanitary water (the demineralizer feed), the regenerant contains (at different times) sodium hydroxide (NaOH), sulfuric acid (H_2SO_4), sodium hydrogen sulfate ($NaHSO_4$), and sodium sulfate (Na_2SO_4). The anionic and cationic demineralizers are regenerated together to maximize the amount of neutral Na_2SO_4 produced, while minimizing the amounts of the acidic (H_2SO_4, $NaHSO_4$) and basic (NaOH) species released.

The CSL is a highly variable stream. The vacuum fractionator effluent, which accounts for as much as 80% of the stream, normally flows only during the PUREX Plant operation and contributes little, if any, contamination. During periods of the PUREX Plant shutdown, concentrations of many components may increase by a factor of five. The primary contributor of detectable solutes, the ion exchanger regenerant, flows intermittently into the CSL and is a highly variable stream, even during regeneration.

The CSL flow rate is dependent upon process activities; the flow rates reported in the stream-specific report ranged from 4.7×10^7 to 1.23×10^8 L/mo (WHC 1990a). The *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) requires that the CSL flowrate be maintained at less than 600 gpm (1×10^8 L/mo) on a monthly average after June 1992. Until the TEDF and BAT systems are complete, the CSL will continue to be discharged to the 216-B-3 Pond or to the 216-A-42 Retention Basin during diversions.

+Dearcide is a registered trademark of W. R. Grace and Company.

4.2.3 Upset Operating Conditions

The CSL could become contaminated during upset conditions.

After the contributors to the CSL have flowed together, the CSL flows through Manhole 4. A flowmeter in Manhole 4 measures the flow rate of the CSL. The flow rate of the CSL determines the activity of a flow totalizer and flow-proportional sampler. A continuously operating sample pump located in Manhole 4 transfers a small stream from the CSL into the 295-AC sample shack, where the stream passes through a pH monitor and a radiation process control monitor. This side stream also passes by a grab sampler (used for taking the characterization samples) and a flow proportional sampler used for providing a record. The radiation monitor is sensitive to gamma radiation and automatically diverts the CSL to the 216-A-42 Retention Basin when the count rate exceeds the alarm limit. Standard plant operating procedures require manual diversion of the CSL if the pH drops below 3 or exceeds 11. The current pH alarm settings are 5 and 11.

4.2.4 Waste Water Discharge Criteria

Currently, the CSL is disposed of to the 216-B-3 Pond. *Environmental Compliance*, WHC-CM-7-5 (WHC 1991a) contains the acceptance criteria for B-Pond. All water effluent flow to ponds or cribs will cease by 1996 when water must be discharged to a State Approved Land Disposal Structure (SALDS).

The CSL will be discharged to a SALDS on or before the 1996 regulatory deadline. This is the currently recommended option. The discharge criteria for PUREX waste water effluents then become the acceptance criteria for a SALDS.

Based on Washington State Department of Ecology (Ecology) guidance WAC 173-303 (WAC 1987a), a SALDS will consider an effluent that is below the most restrictive of the following criteria as acceptable for soil column discharge (Mishko 1990):

- Primary maximum contaminant levels (MCL)
- Secondary MCL
- Proposed MCL
- WAC groundwater quality enforcement limits.

Acceptance criteria for a SALDS are the same as acceptance criteria for the TEDF. The TEDF will have emergency treatment capability, but its main functions will be equalization and holding during laboratory analyses. The TEDF will not be designed nor permitted to accept any effluent that is considered to be a dangerous waste under WAC 173-303 (WAC 1987a).

A listing of the most restrictive criteria was prepared for the purposes of establishing acceptance criteria for the TEDF. This list is reproduced in Section 16.2. The most restrictive single value for each parameter is given in Table 16-1. If a wastewater does not meet these criteria it is not necessarily a hazardous waste, but is rather a stream which may not be acceptable for discharge to a SALDS.

To be acceptable for discharge to the SALDS, the radionuclide content of each waste stream will be required to meet the intent of the state's groundwater standards and limit annual public exposure to an effective dose equivalent not to exceed 4 mrem/yr. The effective dose equivalent of 4 mrem/yr is equal to 4% of the derived concentration guide (DCG) (DOE 1990a).

9 3 1 2 7 3 3 1 2 1 7

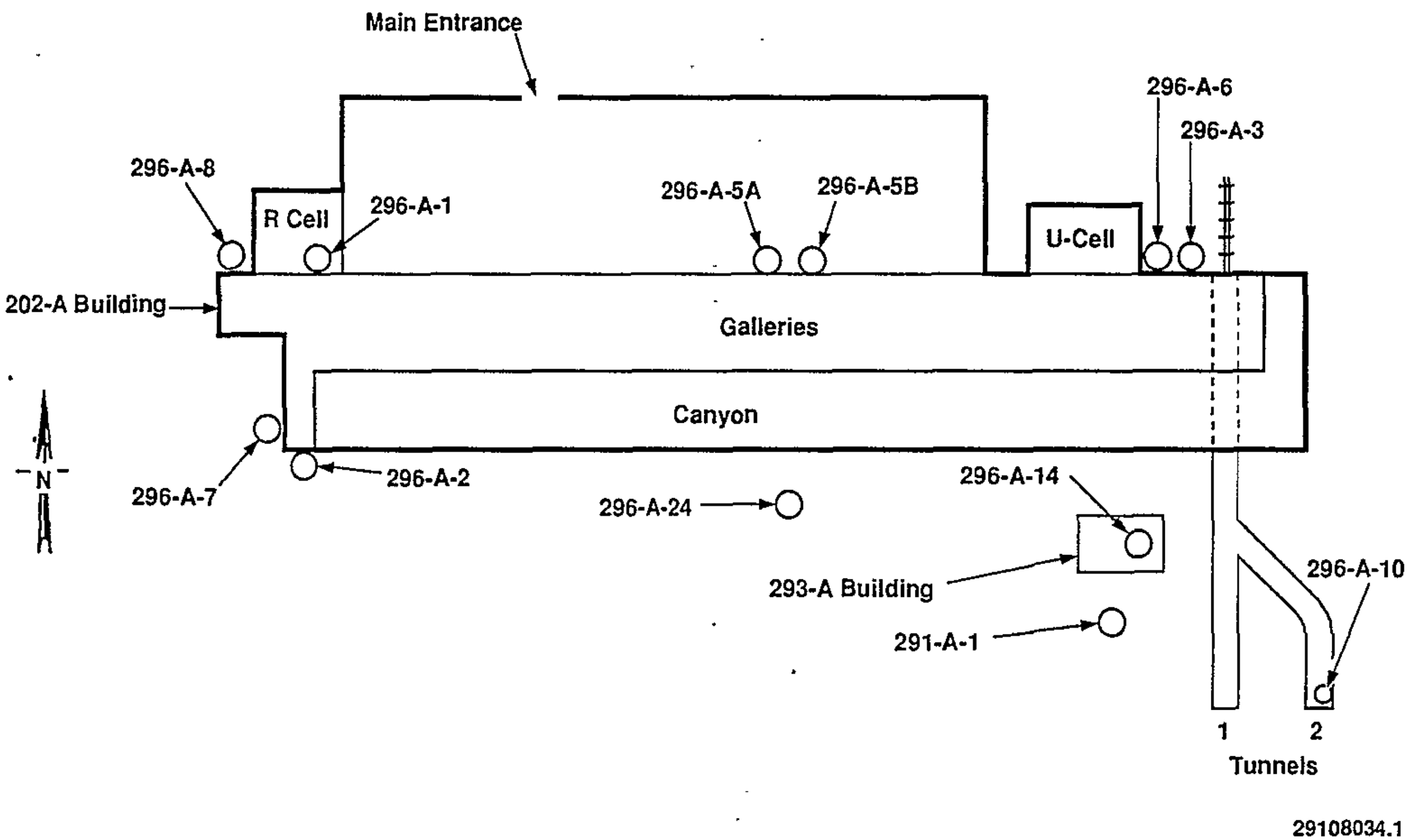

Figure 4-1. Plutonium-Uranium Extraction Plant Exhaust Stacks.

Table 4-1. Stack 291-A-1 Radionuclide Content for the Last Three Quarters of 1990 (μCi/mL).

Nuclide	Concentration*
^{3}H	2.9 E-10
^{14}C	2.6 E-11
^{90}Sr	2.3 E-13
^{103}Ru	3.2 E-14
^{106}Ru	2.9 E-13
^{113}Sn	3.4 E-14
^{125}Sb	2.2 E-13
^{129}I	1.0 E-11
^{131}I	2.5 E-13
^{137}Cs	2.2 E-15
^{147}Pm	1.6 E-14
^{212}Pb	4.2 E-13
^{238}Pu	2.9 E-16
^{239}Pu	5.1 E-15
^{241}Am	4.3 E-16

*Calculated from preliminary data for the last three quarters of calendar year 1990. The same set of data was used in *Facility Effluent Monitoring Plan Determinations for the 200 Area Facilities*, WHC-EP-0440.

Table 4-1a. Final 1990 Radionuclide Airborne Releases from 291-A-1 (A552), 200 East Area.

Radionuclide	Release (Ci)	Average Concentration (μCi/mℓ)
^{3}H	1.7 E+01	1.0 E-08
^{14}C	5.7 E-01	3.5 E-10
^{85}Kr[a]	5.7 E+03	3.6 E-06
^{90}Sr	1.2 E-03	7.3 E-13
^{95}Zr	ND	<1.9 E-14
^{95}Nb	ND	<9.8 E-15
^{103}Ru	4.2 E-05	2.6 E-14
^{106}Ru	1.4 E-03	8.6 E-13
^{113}Sn	2.4 E-04	1.5 E-13
^{125}Sb	1.5 E-03	9.0 E-13
^{129}I	1.1 E-01	6.6 E-11
^{131}I	1.4 E-03	8.6 E-13
^{134}Cs	ND	<1.0 E-14
^{137}Cs	2.1 E-05	1.3 E-14
^{144}Ce	ND	<9.7 E-14
^{147}Pm	1.9 E-04	1.2 E-13
^{212}Pb	2.9 E-02	1.8 E-11
^{220}Rn	3.6 E+02	2.2 E-07
^{238}Pu	2.1 E-06	1.3 E-15
^{239,240}Pu	3.2 E-05	1.9 E-14
^{241}Pu	1.6 E-04	1.0 E-13
^{241}Am	3.8 E-06	2.4 E-15

[a]The release of value and concentration for ^{85}Kr are calculated form the plant inventory and stack flow, respectively; it is not a measured effluent.

ND = None detected.

Table 4-1b. Radionuclide Air Emissions in 1991 from 291-A-1 (A552), 200 East Area.

Radionuclide	Release (Ci)	Average Concentration ($\mu Ci/m\ell$)
^{3}H	1.0 E-00	7.6 E-10
^{14}C	8.1 E-02	6.1 E-11
^{90}Sr	7.9 E-04	6.0 E-13
^{95}Zr	ND	<1.8 E-14
^{95}Nb	ND	<1.1 E-14
^{103}Ru	ND	<2.0 E-13
^{106}Ru	2.8 E-03	2.1 E-12
^{113}Sn	ND	<2.3 E-13
^{125}Sb	ND	<1.5 E-12
^{129}I	4.8 E-02	3.6 E-11
^{131}I	ND	<1.8 E-13
^{134}Cs	ND	<9.6 E-15
^{137}Cs	3.0 E-03	2.2 E-12
^{144}Ce	2.3 E-04	1.8 E-13
^{147}Pm	6.5 E-04	4.9 E-13
^{212}Pb	2.7 E-03	2.0 E-12
^{220}Rn	3.3 E-01	2.5 E-08
^{238}Pu	3.2 E-06	2.4 E-15
$^{239,240}Pu$	3.8 E-05	2.8 E-14
^{241}Pu	2.9 E-04	2.2 E-13
^{241}Am	3.5 E-04	2.6 E-13

ND = None detected.

Table 4-2. Plutonium-Uranium Extraction Plant Stack Exhaust Data.

Stack reference	Height		Stack diameter		Outlet diameter		Average flow[2]		Temperature	
	(ft)	(m)	(ft)	(m)	(ft)	(m)	(ft^3/min)	(m^3/s)	(°C)	(°K)
291-A-1	200	61.0	7.0	2.13	7.0	2.13	1.2 E+05	56.00	35	308
296-A-1	74	22.6	2.0	0.61	1.8	0.53	4,300	2.03	25	298
296-A-2	78	23.8	1.7	0.51	1.3	0.41	3,400	1.60	25	298
296-A-3	74	22.6	1.7	0.51	1.3	0.41	3,400	1.60	25	298
296-A-5A[1]	89	27.1	3.5	1.07	3.0	0.91	16,000	7.55	25	298
296-A-5B[1]	89	27.1	3.5	1.07	3.5	1.07	16,000	7.55	25	298
296-A-6	74	22.6	3.3	1.02	2.8	0.84	14,000	6.61	25	298
296-A-7	78	23.8	3.7	1.12	3.3	1.02	16,000	7.55	25	298
296-A-8	34	10.4	3.3	1.02	3.3	1.02	13,000	6.14	25	298
296-A-10	20	6.1	2.0	0.61	2.0	0.61	3,500	1.65	25	298
296-A-14	42	12.8	2.0	0.61	2.0	0.61	4,000	1.89	25	287

[1]Stack 5A and 5B do not operate concurrently; only one is operational at any given time.

[2]Average flow from 1984 to 1988.

Table 4-3. Distances from the Plutonium-Uranium Extraction Plant to the Hanford Site Boundary.

Direction	Distance (km)
N	23.67
NNW	21.02
NW	21.30
WNW	20.71
W	20.42
WSW	20.71
SW	19.53
SSW	17.75
S	20.73
SSE	22.19
SE*	27.22
ESE*	23.96
E*	18.05
ENE	18.34
NE	21.30
NNE	26.63

*Distances to actual public residences are the same as to boundary locations.

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Table 4-4. Summary of Wind Data.[1]

Sector	Wind direction[2] frequency of occurrence	Average wind speed (m/s)
N	0.042	2.74
NNW	0.034	2.25
NW	0.038	1.94
WNW	0.034	1.52
W	0.035	1.54
WSW	0.024	1.86
SW	0.027	1.66
SSW	0.036	2.22
S	0.060	2.02
SSE	0.065	2.41
SE	0.143	4.00
ESE	0.155	4.08
E	0.128	3.44
ENE	0.080	3.86
NE	0.057	4.58
NNE	0.038	4.07

[1]Data calculated from Joint Frequency Distribution for the 200 Area Meteorological Station at the 10 m Level.
[2]Wind direction is "toward" the indicated sector from a central point location.

Table 4-5. CHI/Q Values for the 16 Wind Sectors Surrounding the Plutonium-Uranium Extraction Plant.

Direction	CHI/Q (s/m^3)
E	9.1 E-09
NNW	8.5 E-09
NW	9.5 E-09
WNW	9.0 E-09
W	8.8 E-09
WSW	5.2 E-09
SW	6.5 E-09
SSW	9.2 E-09
S	1.3 E-08
SSE	1.3 E-08
SE	1.8 E-08
ESE	2.6 E-08
E*	3.2 E-08
ENE	1.8 E-08
NE	1.1 E-08
NNE	6.1 E-09

*Represents the maximum CHI/Q and the sector containing the Maximally Exposed Individual for releases from the main stack (291-A-1).

Table 4-6. Screening Analysis for the Most Significant Radionuclide Releases.

Nuclide	Release[1] (Ci/yr)	Inhal.[2] cnvrsn factor (rem/μCi)	Ingest[2] cnvrsn factor (rem/μCi)	Air-sub[2] cnvrsn factor[3] (mrem-m^3 / μCi/yr)	Prod-1 inhal (rem-Ci / μCi/yr)	Prod-2 ingest (rem-Ci / μCi-yr)	Prod-3 air (mrem-m^3-Ci / μCi-yr^2)
^{90}Sr	4.0 E-04	1.3 E+00	1.3 E-01	0.0 E+00	5.2 E-04	5.2 E-05	0.0 E+00
^{106}Ru	5.2 E-04	4.4 E-01	2.1 E-02	0.0 E+00	2.3 E-04	1.1 E-05	0.0 E+00
^{113}Sn	5.9 E-05	3.4 E-05	1.0 E-04	1.3 E+03	2.0 E-09	5.9 E-09	2.1 E-02
^{125}Sb	3.9 E-04	9.8 E-03	2.6 E-03	2.1 E+03	3.8 E-06	1.0 E-06	8.2 E-01
^{137}Cs	3.8 E-06	3.2 E-02	5.0 E-02	0.0 E+00	1.2 E-07	1.9 E-07	0.0 E+00
^{147}Pm	2.8 E-05	3.4 E-02	9.5 E-04	1.8 E-02	9.5 E-07	2.7 E-08	5.0 E-08
^{238}Pu	5.1 E-07	4.6 E+02	3.8 E+00	4.4 E-01	2.2 E-04	1.9 E-06	2.2 E-07
^{239}Pu	9.0 E-06	5.1 E+02	4.3 E+00	4.1 E-01	4.5 E-03	3.9 E-05	3.7 E-06
^{241}Am	7.5 E-07	5.2 E+02	4.5 E+00	9.5 E+01	4.0 E-04	3.4 E-06	7.1 E-05

[1]Based on averaged and normalized second, third, and forth quarter 1990 preliminary concentration and flow data for stack 291-A-1.

[2]Dose Conversion Factors are from DOE 1990a which represent the ICRP 26/30 Methodologies.

Table 4-7. Significant Radionuclide Releases from the Plutonium-Uranium Extraction Plant During Standby[1] (In Curies per Year).

Stack reference	Significant radionuclide			
	^{90}Sr	^{238}Pu	^{239}Pu	^{241}Am
291-A-1	4.0 E-04	5.1 E-07	9.0 E-06	7.5 E-07
296-A-1	NA[2]	NA	5.8 E-07	2.9 E-07
296-A-2	NA	NA	1.6 E-08	3.8 E-08
296-A-3[3]	NA	NA	NA	NA
296-A-5A	NA	NA	7.6 E-08	1.6 E-07
296-A-6	NA	NA	7.1 E-08	1.5 E-07
296-A-7	NA	NA	4.0 E-07	1.6 E-07
296-A-8	NA	NA	7.0 E-08	1.3 E-07
296-A-10	NA	NA	8.7 E-09[4]	NA
296-A-14	3.6 E-07[5]	NA	5.8 E-09[4]	NA
Total	4.1 E-04	5.1 E-07	1.0 E-05	1.8 E-06

[1]Most significant radionuclides contributing to dose assessment from Table 4-6.

[2]NA indicates no analysis was required or performed for the radionuclide listed.

[3]Average radionuclide concentrations were indisguishable from background.

[4]The ^{239}Pu concentration inferred from total α data as a worst case scenario.

[5]The ^{90}Sr concentration inferred from total β data as a worst case scenario.

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Table 4-8. Doses to the Maximally Exposed Individual from Routine Standby Mode Releases.

Stack reference	Effective dose equivalent (mrem)	Stack contribution to MEI dose (%)	Standard for* required monitoring (mrem)
291-A-1	1.4 E-02	99.4	1.0 E-01
296-A-1	3.5 E-05	0.25	1.0 E-01
296-A-2	2.3 E-06	0.02	1.0 E-01
296-A-3	0.0 E+00	0.00	1.0 E-01
296-A-5A/5B	1.1 E-05	0.08	1.0 E-01
296-A-6	1.0 E-05	0.07	1.0 E-01
296-A-7	2.2 E-05	0.16	1.0 E-01
296-A-8	9.5 E-06	0.07	1.0 E-01
296-A-10	3.0 E-07	0.00	1.0 E-01
291-A-14	2.6 E-07	0.00	1.0 E-01
Total	1.4 E-02	100.05	

*Dose standard for required radioactivity effluent monitoring (EPA 1989a).

Table 4-9. Doses to the Maximally Exposed Individual from an Unmitigated Release.

Stack reference	Effective dose equivalent (mrem)	Unmitigated release factor (dimensionless)	Unmitigated effective dose equivalent (mrem)	Dose standard* for required monitoring (mrem)
291-A-1 Volatiles	1.4 E-02	1.0 E+00	1.4 E-05	
Particulates	1.4 E-05	3.0 E+03	4.1 E-04	
Total	1.4 E-02	-------	4.3 E-04	1.0 E-01
296-A-1	3.5 E-02	3.0 E+03	1.06 E-01	1.0 E-01
296-A-2	2.3 E-03	3.0 E+03	6.7 E-03	1.0 E-01
296-A-3	0.0 E+00	3.0 E+03	0.0 E+00	1.0 E-01
296-A-5A/5B	1.1 E-05	3.0 E+03	3.2 E-02	1.0 E-01
296-A-6	1.0 E-05	3.0 E+03	3.0 E-02	1.0 E-01
296-A-7	2.2 E-05	3.0 E+03	6.6 E-02	1.0 E-01
296-A-8	9.5 E-06	3.0 E+03	2.8 E-02	1.0 E-01
296-A-10	3.0 E-07	3.0 E+03	9.1 E-04	1.0 E-01
296-A-14	2.6 E-07	3.0 E+03	7.9 E-04	1.0 E-01

*Dose standard for total radioactivity effluent monitoring (EPA 1989a).

Table 4-10. Individual Radionuclide Doses to the Maximally Exposed Individual from an Unmitigated Release.

PUREX Stack	Radionuclide	EDE Contribution (rem/yr)	Contribution to stack total (%)
291-A-1	^{239}Pu	2.56 E-01	60
	^{90}Sr	6.15 E-02	14
296-A-1	^{241}Am	4.56 E-02	43
	^{239}Pu	6.00 E-02	57

Table 4-11. Summary of Plutonium-Uranium Extraction Plant Liquid Effluent Qualities.[1] (4 sheets)

Analyte	CWL[5]	SCD[5]	CSL[5] IX Regen[2]	CSL[5] Routine
Inorganic Compounds - Metals[3]				
Aluminum			499	341
Antimony				
Arsenic				
Barium	32	30	113	34
Beryllium				
Boron	25	24		22
Cadium			11	
Calcium	1.9 E+04	1.8 E+04	5.9 E+04	1.9 E+04
Chromium				
Copper	11		1,310	40
Iron	53	32	675	443
Lead			30	6
Magnesium	4.5 E+03	4.3 E+03	1.2 E+04	4,350
Manganese	7		58	30
Mercury			1.7	0.1
Nickel			15	
Potassium	772	713	3,360	740
Selenium				
Silicon	2.6 E+03	2.3 E+03		2,910
Silver			17	
Sodium	2.2 E+03	2.1 E+03	4.0 E+05	2,160
Strontium	100	88	353	95
Thallium				
Uranium	0.5	0.6	1.3	0.6
Zinc	8	6	416	25

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Table 4-11. Summary of Plutonium-Uranium Extraction Plant Liquid Effluent Qualities.[1] (4 sheets)

Analyte	CWL[5]	SCD[5]	CSL[5] IX Regen[2]	CSL[5] Routine
Inorganic compounds - Ionic Species[3]				
Ammonium	52		79	63
Chloride	1.2 E+03	1.0 E+03	2.6 E+04	1.8 E+03
Cyanide			12	
Fluoride	146	123		154
Fluoride (IC)			3,390	
Fluoride (ISE)			213	
Nitrate	628	582	7.0 E+04	588
Sulfate	1.1 E+04	9.8 E+03	1.5 E+06	1.3 E+04
Organic Compounds[3]				
Acetone	11	10	148	
1-Butanol		24		
2-Butanone	10			
Butylated				
Hydroxytoluene	10			10
Chloroform			240	
Dibutyl phosphate				
Dichloromethane	6		15	
Tributylphosphate		12		
Other Parameters[3]				
Alkalinity	6.2 E+04	5.8 E+04		6.6 E+04
Conductivity (μS)	154	146	3,990	158
pH (dimensionless)	7.9	7.7	6.6	7.8
TDS	7.2 E+04	6.6 E+04		6.5 E+04
Temperature (°C)	20	22	29	28
TOC	1.1 E+03	1.1 E+03	1.08 E+04	
Total Carbon	1.6 E+04	1.5 E+04		1.5 E+04
TOX (as Cl)	11	8	266	99
Radionuclides[4]				

Table 4-11. Summary of Plutonium-Uranium Extraction Plant Liquid Effluent Qualities.[1] (4 sheets)

Analyte	CWL[5]	SCD[5]	CSL[5] IX Regen[2]	CSL[5] Routine
Total Alpha		7	4	1
Total Beta		224	11	2
^{226,228}Ra		<4.4 E+00		<1.9 E-01
Gross uranium-natural				4.9 E+02
^{3}H				4.9 E+02
^{14}C	6.3 E+00			4.28 E+00
^{90}Sr	3.9 E-01	3.3 E+00		
^{129}I	1.5 E-01			
^{137}Cs		1.6 E-01		4.6 E-01
^{144}Ce/Pr		3.4 E+02		
^{147}Pm				
^{234}U	2.6 E-01	2.6 E-01		1.9 E-01
^{238}Pu		5.5 E-01		1.6 E-02
^{238}U	1.9 E-01	1.8 E-01		1.6 E-01
^{239,240}Pu		7.2 E+00		5.3 E-01
^{239,240}U	3.5 E-03			
^{241}Am	4.8 E-03	8.7 E-01		2.0 E-01
Stream-Specific Report (WHC 1990a) Addendum Number	Addendum 20	Addendum 5	Addendum 2	Addendum 2
Approximate Average Flow Rate (L/mo)	5.2 E+08	4.3 E+07		7.7 E+07

Table 4-11. Summary of Plutonium-Uranium Extraction Plant Liquid Effluent Qualities.[1] (4 sheets)

Analyte	CWL[5]	SCD[5]	CSL[5] IX Regen[2]	CSL[5] Routine
Estimated Flow Rate for PUREX Shutdown Condition (L/mo)	1.0 E+07	1.0 E+07		5.0 E+07
Estimated Flow Rate for PUREX Standby (L/mo)	0	0		5.0 E+07

[1]Analyte concentrations represented by the estimated 90% confidence limit (the upper limit of the one-tailed 90% confidence interval) as reported in the appropriate stream-specific report. When a 90% confidence interval limit was not estimated, the maximum observed result is listed.

[2]Effluent quality for CSL waste stream during ion exchange (demineralizer) regeneration operations.

[3]Effluent concentrations expressed as μg/L unless indicated otherwise.

[4]Effluent concentrations for radionuclides expressed as picocuries per liter.

[5]Abbreviations used:
TDS = total dissolved solids
TOC = total organic carbon
TOX = total organic halides
MS = microsiemen
IC = fluoride analysis using ion chromatography technique
ISE = fluoride analysis using ion-specific electron technique.

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Table 4-12a. Plutonium-Uranium Extraction Chemical Sewer (CSL) to 216-B-3 Pond, 200 East Area (H118) in 1990.

Radionuclide	Release (Ci)	Average Concentration ($\mu Ci/m\ell$)
^{3}H	5.6 E-01	7.6 E-07
^{90}Sr	1.3 E-02	1.7 E-08
^{103}Ru	2.2 E-02	3.0 E-08
^{106}Ru	3.8 E-02	5.2 E-08
^{137}Cs	4.8 E-02	6.5 E-08
^{147}Pm	ND	<9.0 E-07
$^{239,240}Pu$	8.2 E-03	1.1 E-08
^{241}Am	1.6 E-02	2.2 E-08
Gross α	2.3 E-03	3.2 E-09
Gross ß	6.5 E-03	8.8 E-09
Volume	7.4 E+08 L	

ND = None detected.

Table 4-12b. Plutonium-Uranium Extraction Chemical Sewer (CSL) to 216-B-3 Pond, 200 East Area in 1991 (H118).

Radionuclide	Release (Ci)	Average Concentration (μCi/mℓ)
^{3}H	4.1 E-01	5.1 E-07
^{90}Sr	1.5 E-02	2.4 E-08
^{103}Ru	ND	<3.7 E-08
^{137}Cs	5.0 E-02	6.2 E-08
^{147}Pm	ND	<9.0 E-07
$^{239,240}Pu$	1.9 E-02	2.3 E-08
^{241}Am	2.6 E-02	3.2 E-08
Total α	2.0 E-03	2.4 E-09
Total β	3.9 E-03	4.7 E-09
Volume	8.2 E-08 ℓ	

ND = None detected.

Table 4-13a. Plutonium-Uranium Extraction Cooling Water (CWL) to 216-B-3 Pond, 200 East Area in 1990 (H119).

Radionuclide	Release (Ci)	Average Concentration ($\mu Ci/m\ell$)
^{3}H	3.5 E+00	9.7 E-07
^{90}Sr	1.0 E-01	2.7 E-08
^{103}Ru	1.1 E-01	2.9 E-08
^{106}Ru	2.0 E+00	5.5 E-07
^{137}Cs	2.4 E-01	6.7 E-08
^{147}Pm	ND	<9.0 E-07
$^{239,240}Pu$	4.3 E-02	1.2 E-08
^{241}Am	8.7 E-02	2.4 E-08
Gross α	9.0 E-03	2.5 E-09
Gross β	7.9 E-02	2.2 E-08
Volume	3.6 E+09 L	

ND = None detected.

Table 4-13b. Plutonium-Uranium Extraction Cooling Water (CWL) to 216-B-3 Pond, 200 East Area in 1991 (H119).

Radionuclide	Release (Ci)	Average Concentration ($\mu Ci/m\ell$)
^{3}H	2.1 E-01	6.8 E-06
^{90}Sr	7.9 E-02	2.6 E-08
^{103}Ru	ND	<3.5 E-08
^{106}Ru	ND	<6.6 E-07
^{137}Cs	2.5 E-01	8.3 E-08
^{147}Pm	ND	<9.0 E-07
$^{239,240}Pu$	ND	<2.8 E-08
^{241}Am	ND	<3.3 E-08
Total α	1.2 E-02	3.9 E-09
Total β	2.0 E-01	6.6 E-08
Volume	3.6 E+09 ℓ	

ND = None detected.

Table 4-14. List of Plutonium-Uranium Extraction Plant Chemicals.

Aluminum nitrate	
Antifoam (DOW 110)	Cadmium nitrate
Ferric nitrate	Ferrous sulfamate
Hydrazine	Hydrogen peroxide
Hydroxylamine nitrate	Ion exchange resins
Nitric acid	Normal paraffin hydrocarbon
Oxalic acid	Potassium fluoride
Potassium hydroxide	Potassium permanganate
Silver nitrate	Sodium carbonate
Sodium nitrate	Sodium nitrite
Sodium thiosulfate	Sugar (sucrose)
Sulfamic acid	Sulfuric acid
Tartaric acid	Tributyl phosphate
Cleaning surfactants	

Table 4-15a. Plutonium-Uranium Extraction (PUREX) Steam Condensate to 216-A-30 Crib at 67% and 216-A-37-2 Crib at 33% (H124) in 1990.

Radionuclide	Release Ci	Average Concentration ($\mu Ci/m\ell$)
^{3}H	8.6 E-01	2.6 E-06
^{90}Sr	6.5 E-03	1.9 E-08
^{103}Ru	9.8 E-03	2.9 E-08
^{106}Ru	1.9 E-01	5.8 E-07
^{113}Sn	1.3 E-02	4.0 E-08
^{137}Cs	2.1 E-02	6.4 E-08
^{147}Pm	ND	<9.0 E-07
Gross U	5.8 E-04	1.7 E-09
^{238}Pu	7.5 E-03	2.3 E-08
$^{239,240}Pu$	6.4 E-03	1.9 E-08
^{241}Am	6.6 E-03	2.0 E-08
Gross α	4.4 E-03	1.3 E-08
Gross β	8.5 E-02	2.6 E-07
Volume	2.7 E+08 L	

ND = None detected.

Table 4-15b. Plutonium-Uranium Extraction (PUREX) Steam Condensate to 216-A-30 Crib at 67% and 216-A-37-2 Crib at 33% (H124) in 1991.

Radionuclide	Release Ci	Average Concentration (μCi/mℓ)
^{3}H	8.1 E-01	3.0 E-06
^{90}Sr	ND	<1.6 E-08
^{103}Ru	ND	<3.5 E-08
^{106}Ru	ND	<6.3 E-07
^{113}Sn	ND	<4.8 E-08
^{137}Cs	ND	<5.6 E-08
^{147}Pm	ND	<9.0 E-07
U, total	2.8 E-04	1.0 E-09
$^{239,240}Pu$	ND	<2.2 E-08
^{241}Am	9.9 E-03	3.7 E-08
Total α	1.2 E-03	4.6 E-09
Total ß	2.7 E-03	1.0 E-07
Volume	2.7 E+08 ℓ	

ND = None detected.

Table 4-16. Summary of Effluent Releases From the Plutonium-Uranium Extraction (PUREX) Steam Condensate and the 216-A-42 Retention Basin Releases to 216-A-30 and 216-A-37-2 Cribs in 1990.

SCD and A-42 Retention summary.		
Radionuclide	Release Ci	Average Concentration (μCi/mℓ)
^{3}H	8.7 E-01	2.6 E-06
^{90}Sr	1.2 E-01	1.9 E-08
^{103}Ru	6.1 E-02	1.8 E-07
^{106}Ru	1.9 E-01	5.8 E-07
^{113}Sn	1.3 E-02	4.0 E-08
^{137}Cs	5.4 E-02	1.6 E-07
^{147}Pm	3.7 E-01	1.1 E-06
Gross U	5.8 E-04	1.7 E-09
^{238}Pu	9.5 E-03	2.8 E-08
^{239,240}Pu	3.2 E-02	9.6 E-08
^{241}Am	7.0 E-03	2.1 E-08
Gross α	3.0 E-02	8.9 E-08
Gross β	6.5 E-01	1.9 E-06
Volume	3.4 E+08 L	

Table 4-17. Plutonium-Uranium Extraction Cooling Water (CWL) and 216-A-42 Retention Basin Discharge to 216-B-3 Pond in 1990.

Radionuclide	Release (Ci)	Average Concentration (μCi/mℓ)
^{3}H	3.5 E+00	9.7 E-07
^{90}Sr	1.0 E-01	2.7 E-08
^{103}Ru	1.1 E-01	2.9 E-08
^{106}Ru	2.0 E+00	5.5 E-07
^{137}Cs	2.4 E-01	6.7 E-08
^{147}Pm	3.3 E+00	9.0 E-07
^{238}Pu	4.6 E-05	1.3 E-11
^{239,240}Pu	4.4 E-02	1.2 E-08
^{241}Am	8.7 E-02	2.4 E-08
Gross α	9.1 E-03	2.5 E-09
Gross ß	8.2 E-02	2.3 E-08
Volume	3.6 E+09 L	

Table 4-18. Nonradioactive Constituents in Radioactive Liquid Effluents in the 200 Areas in 1991.

Stream Code	Effluent Source	Nitrate[a] Annual Average (mg/ℓ)	Nitrate Annual Mass (kg)	TOC Monthly Maximum (mg/ℓ)	TOC Annual Mass (kg)
CSL	PUREX chemical sewer	2	1,178	30	5,711
A-42[b]	PUREX diversion basin	2	7	55	22

[a]Values for nitrate are reported as NO_3.
[b]A-42 had no discharges after January 1991.

5.0 EFFLUENT POINT OF DISCHARGE DESCRIPTION

This chapter describes the point of discharge for both the air and liquid effluents.

5.1 AIR EFFLUENTS

The 10 major air effluent streams dimensions and heights have been summarized previously in Table 4-2. The location of each stack is shown in Figure 4-1. Additional information on each discharge is given in Section 4.1.1 Descriptions.

5.2 WATER EFFLUENTS

The only remaining water effluent from the PUREX Plant, the CSL, discharges into B Pond. Under the Tri-Party Agreement, this discharge is limited to no more than 38 L/s (600 gal/min) average on a monthly basis.

B Pond comprises four interconnected unlined earthen ponds, designated as 216-B-3, 216-B-3A, 216-B-3B, and 216-B-3C. These ponds were placed into service in 1945, 1983, 1984, and 1985, respectively. Figure 5-1 shows the location of B Pond in relation to adjacent facilities and groundwater monitoring wells.

Currently 216-B-3 covers a surface area of approximately 16 ha (39 acres). Historical records indicate the surface area has varied from 8 to 19 ha (19 to 46 acres) (RL 1990). The maximum depth of the pond is 5.5 m (18 ft). The surface areas of 216-B-3A, 216-B-3B, and 216-B-3C are 4, 4, and 17 ha (10, 10, and 41 acres) respectively. These expansion lobes have a maximum capacity depth of about 1.2 m (4 feet). The -3A and -3B lobes each have a single trench in the bottom, and the -3C lobe has a series of nine trenches. These trenches are approximately 1.2 m (4 ft) in depth and provide additional infiltration capacity. The measured infiltration rate of 216-B-3 is approximately 4 cm/day (1 gal/day/ft^2).

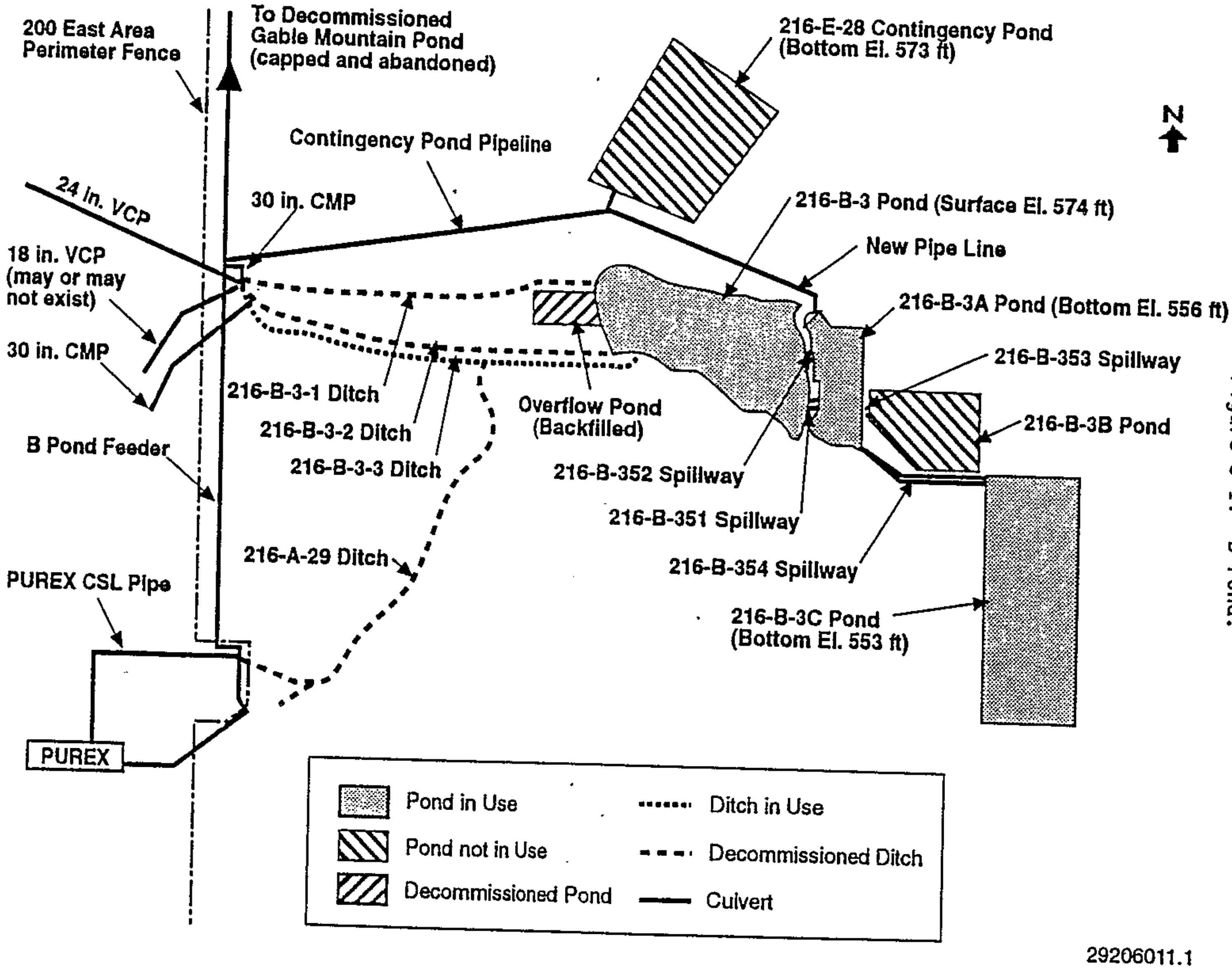

Figure 5-1. B-Pond.

6.0 EFFLUENT MONITORING/SAMPLING SYSTEM DESIGN CRITERIA

The design criteria of a system or equipment state the functional requirements that must be met.

Airborne and liquid radionuclide concentration monitoring requirements at PUREX are met by sampling and analysis. Airborne chemical monitoring requirements are met by real-time monitors.

6.1 AIRBORNE EFFLUENT SAMPLING AND MONITORING SYSTEM DESIGN CRITERIA

Gaseous sampling is required on all gaseous release points with the potential to emit artificial radionuclides. Gaseous monitoring is required on all gaseous release points with the potential to emit ammonia or nitrogen oxides (NO_x). Because the PUREX plant does not produce ammonia or NO_x when it is not processing, there is currently no requirement for ammonia or NO_x monitoring.

Sampling systems for gaseous release points which have a potential to contribute an EDE to the MEI of greater than 1μSv (0.1 mrem) per year are required to meet ANSI N13.1-1969.

Real-time flow monitoring is required on all sampled/monitored release points where the flow is expected to vary. Quarterly pitot traverses provide flow monitoring for those release points which are not expected to have a significantly varying flow. Real time flow monitoring is required to provide measurements within 10% of the actual flow.

6.2 LIQUID EFFLUENT SAMPLING AND MONITORING SYSTEM DESIGN CRITERIA

Liquid radionuclide sampling is required for all released liquid effluents which have the potential to exceed a sum of the fractions of the DCG of 0.04. Sampling is also required for liquid effluents discharged to surface waters with settleable solids exceeding 5 pCi/g alpha or 50 pCi/g beta/gamma emitting radionuclides. The samples are required to be representative: either grab samples of well-mixed batch releases or proportional samples of continuous releases.

Volume measurements are required for liquid effluents which require radionuclide sampling. For continuous releases, the flow measurements are required to be within 10% of the actual flow rate.

Continuous monitoring for pH is required for all released liquid effluents with a potential to have a pH outside the range of 2 to 12.5.

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7.0 CHARACTERIZATION OF CURRENT EFFLUENT MONITORING SYSTEM

Monitoring and Sampling systems must be capable of verifying compliance with the discharge criteria for the specific effluent stream. Air M/S requirements are well defined in NESHAPs (EPA 1989a). Currently, liquid effluent M/S are used to verify compliance with discharge criteria for effluents discharged to 216-B-3 Pond (B Pond). After 1996 liquid effluents must meet the more restrictive SALDS criteria. Monitoring and Sampling of the air and liquid effluents will be conducted in accordance with WHC-CM-7-5 (WHC 1991a).

7.1 AIR EFFLUENT MONITORING SYSTEM DESCRIPTION AND SPECIFICATIONS

7.1.1 Monitoring/Sampling Requirements and Criteria

As a result of the dose analysis presented in Section 4.1.4, specific air M/S requirements have been identified for each of the 11 PUREX stacks. Monitoring requirements fall into two types, "continuous radiation monitoring" [as defined by EPA (EPA 1989a); this is fully met by continuous sampling and periodic analysis] and selective radionuclide monitoring. Continuous air monitoring requires filter analyses for total alpha and/or total beta radioactivity. Selective radionuclide monitoring analyzes the filters for specific radionuclide air concentrations.

Continuous monitoring does not imply a real-time monitoring system, but rather a system that samples continuously so that variations in effluent concentrations are accurately represented by analysis. A continuous air sampler that draws air through and deposits particulates on a filter is an example. Both alpha and beta emitters are present in all PUREX stack effluents.

Stacks and their monitoring requirements are discussed in the following bullets (Table 7-1 summarizes the results of the dose analysis):

- Two stacks, 291-A-1 and 296-A-1, will require radiation monitoring (EPA definition)
- Both stacks will require continuous total alpha/beta monitoring (EPA 1989a)
- The main stack, 291-A-1, will require radionuclide selective analysis for ^{90}Sr and ^{239}Pu
- The 296-A-1 stack will require selective analysis for ^{239}Pu and ^{241}Am

- The other nine stacks in Table 7-1 require only periodic monitoring to verify compliance during standby operations at PUREX
- No stack at PUREX requires monitoring for non-radiological hazardous or EPA criteria pollutants during standby mode

7.1.2 Existing Air Effluent Monitoring/Sampling System

The descriptions of the air effluent M/S program and associated equipment used at the PUREX Plant are compiled from information included in existing effluent monitoring documents (WHC 1988a) and engineering drawings (WHC 1988b, 1988c, 1990c, 1990d, 1990a).

7.1.2.1 291-A-1 Stack Monitoring/Sampling Description. Multipoint sample probes are located at three elevations on the main stack; 18 m, 22.5 m, and 27 m (60, 74, and 88 ft). There are two sample probes at each location. Two of the six probes, one each at 18 and 22.5 m (60 and 74 ft), are used for record effluent sampling purposes. The remaining probes lead to monitors or samplers used for process control or to samplers which are not required during plant standby conditions. Each of the record samplers consists of a filter through which a near isokinetic (±10%) sample is pulled. Automatic flow controllers maintain the near isokinetic sampling conditions.

The particulate filters from the record sampling unit are removed weekly and transferred to the 222-S Laboratory for radiochemical analyses. One sample is designated as the primary record while the other is used as a backup. These analyses include total alpha, total beta and the specific radionuclide analyses.

7.1.2.2 296-A-1 Stack Monitoring/Sampling Description. Samples are removed from the gas stream by stack sampling probe SSP-V28A-1 and routed to a record sampler. As with stack 291-A-1, particles are collected on a filter within the sampler. Flow through the system is manually adjusted when needed to maintain a near-isokinetic sampling condition.

7.1.2.3 Monitoring/Sampling Specifications and Deficiencies. Both the 291-A-1 and 296-A-1 stacks are currently continuously sampled for particulate radioactivity and monitored for flow rate.

A sampling probe provides the capability of analysis of all required radionuclides. Table 7-2 summarizes the current required monitoring and sampling.

The current design, location, and number of sample probes on the main stack are in compliance with ANSI N13.1 (ANSI 1969). However, the sampling system does not meet the EPA flow measurement requirements for continuous sampling. The current stack sampling system uses the best available technology and provides adequate assessment of stack emissions based on historical sample analysis data. The sampling system is well documented.

Additional QA documentation is not available to address all the requirements of 40 CFR 61 (EPA 1989a). However, many of the QA elements are addressed in the *Quality Assurance Project Plan for Radioactive Airborne Emissions Data Compliance and Reporting*, submitted to the EPA (WHC 1992).

7.1.3 Remaining Stacks

Based upon EPA criteria (EPA 1989a), continuous monitoring for the remaining PUREX stacks is not required. However, periodic effluent sampling should be maintained to verify the low radionuclide air releases.

7.1.4 Air Effluent Sampling Program

The gaseous effluent in the main stack (291-A-1) and stack 296-A-1 shall be continuously sampled and periodically analyzed for total alpha and beta radiation and specific radionuclides as the means to provide the required sensitivity. Air samples from 291-A-1 will be analyzed for ^{90}Sr and ^{239}Pu. Air samples from 296-A-1 shall be sampled for ^{239}Pu and ^{241}Am. The M/S program for air effluents is included in Table 7-3. Air sampling shall comply with the criteria provided in applicable Westinghouse Hanford manuals and procedures. Stack flow measurements shall comply with the criteria provided by the EPA (EPA 1989a).

Stack 291-A-1. Air sampling equipment is located at the 22.5 m and 18 m (74 ft and 60 ft) levels of the main stack. Samples are removed from the airstream by stack sampling probes SSP-V19-1 and SSP-V18-2 and routed to record samplers. Particles are collected on filters within the samplers. Flow through the systems is monitored and controlled by flow controllers to ensure near isokinetic sampling.

The particulate filters from the record sampling unit will be removed weekly and transferred to a laboratory for radiochemical analyses. These analyses will include ^{90}Sr and ^{239}Pu determinations. One of the two samples will be designated as the primary sample. While the other sample will normally be handled the same as the record sample, it may be designated for special analysis.

Stack 296-A-1. Samples are removed from the airstream by stack sampling probe SSP-V28A-1 and routed to a record sampler. Particles are collected on a filter within the sampler. This system is capable of near isokinetic sampling, but requires manual adjustment when stack flow conditions change. The stack flow conditions are usually constant.

The particulate filter from the record sampling unit will be removed weekly and transferred to a laboratory for radiochemical analysis. The analyses will include ^{239}Pu and ^{241}Am determinations.

7.2 LIQUID EFFLUENT MONITORING SYSTEM DESCRIPTION AND SPECIFICATIONS

The descriptions of the liquid effluent M/S program and associated equipment used at the PUREX Plant are compiled from information included in existing monitoring documents (WHC 1989a, 1990g) and engineering drawings (WHC 1990e, 1990b, 1990f).

7.2.1 Monitoring/Sampling Requirements

Currently, the contaminant concentrations in the CSL must meet regulatory requirements. After 1996, more restrictive SALDS criteria must be met. Table 7-4 compares the SALDS acceptance criteria with the value, that was reported in the stream-specific report (WHC 1990a) as the 90% confidence limit for the CSL.

7.2.1.1 Routine Conditions. The following are observed after review of the discharge criteria and available stream-specific data.

- Some effluent concentrations exceed the SALDS acceptance criteria.
- The selection of analytes for characterization is not uniform.
- The selection of analytes is not consistent with the discharge criteria parameters.
- The waste stream characterizations must be refined before discharge to the SALDS commences.

These deficiencies in the database are largely a function of project scope. The stream-specific reports were prepared to evaluate whether the waste streams were designated dangerous wastes pursuant to the WAC 173-303 (WAC 1987a). Process knowledge and historic sampling data were used to select the analytical tests. It was not the intention of the stream-specific project to determine whether the waste stream quality meet possible future discharge criteria.

7.2.1.2 Monitoring/Diversion Interface. At the present time, the only mitigating control on effluent discharge from the PUREX Plant is in-line monitoring with the capability for automatic diversion to the concrete lined retention basin. However, the existing monitoring system does not appear to be adequate for detecting releases that exceed the discharge criteria.

Because of the difference between detection and release limits, it is possible to exceed the annual release limits without detection. The detection limits of the continuous effluent monitors that are used to activate the diversion controls are 3 to 5 orders of magnitude greater than the most restrictive limits established in Section 4.2.4. Weekly process control samples will identify releases greater than annual limits. Past upset conditions have typically produced releases an order of magnitude greater than alarm limits.

In addition, the CSL is not monitored continuously for pure beta emitters, such as strontium, which have extremely low release limits and are difficult to quantify in aqueous solutions. Transit time from the point of monitoring to the diversion valve exceeds the response time of the monitors, so all upset flow is diverted.

7.2.1.3 **Monitoring/Sampling Criteria.** During routine operations of the PUREX plant, the contaminant concentrations in the CSL were below the most restrictive of applicable federal and state standards for water quality. The contaminant concentrations are also expected to meet the intent of the state's groundwater protection standards while the plant is in a standby operational mode. The M/S activities will be performed to show continuing compliance with applicable WAC/EPA regulations and appropriate discharge criteria.

The existing monitoring instrumentation lacks the sensitivity to detect radionuclides in liquid effluent at the concentrations adopted as SALDS acceptance criteria. Furthermore, instrumentation that can attain these sensitivities is not commercially available, nor is it likely that this type of instrumentation will be developed in the near future. As a result, instrument monitoring will be useful only for detecting and quantifying upset releases. Data for establishing environmental baseline conditions and determining compliance status will be collected by sampling and analyses.

The sampling strategy must include provisions for correcting the deficiencies noted in this chapter. Uniformity and consistency must be incorporated in the sampling and analysis plan to ensure that the database contains the information necessary for making an informed judgement as to the acceptability of effluent for disposal at the SALDS. The sampling criteria are summarized below and are presented in more detail in Sections 10.2 and 10.3.

7.2.2 CSL Effluent Monitoring/Sampling System

7.2.2.1 **CSL Monitoring/Sampling Description.** The CSL monitoring equipment is located in the 295-AC Building and includes continuous pH, gamma radiation, and flow monitoring. Excursions above or below pH limits, beta/gamma radiation alarm limits, and flow rates below set limits results in alarms in the central control room. Radiation and alarm point triggers automatic diversion of the CSL to 216-A-42 Retention Basin and collection of verification samples. Samples are collected from the sample tank weekly for analysis. On a monthly basis, the weekly samples are combined in a flow proportional composite for environmental release records.

7.2.2.2 **CSL Monitoring/Sampling Specifications.** Table 7-7 describes the normal operating parameters for the CSL stream.

7.2.2.3 **CSL Monitoring/Sampling Deficiencies.** The minimum detection limit for ^{241}Am, ^{239}Pu, and ^{240}Pu, which should be equal to 4% of the DCG for discharge to SALDS, will not be met. The current detection limits at the 222-S Laboratory are 5.0 x 10^{-9} μCi/mL for Plutonium and 1.2 x 10^{-8} μCi/mL for americium (WHC 1990g). Revised detection limits, based upon 4% of the DCG, of 1.2 x 10^{-9} μCi/mL for both are required. The monitoring systems for both radioactive and nonradioactive liquid discharges have no source of backup power in the event of a power failure, but they should (WHC 1990g).

7.2.3 Liquid Effluents Monitoring Program

The currently available alpha and beta/gamma monitoring equipment is inadequate for determining compliance with discharge criteria. As a result, real-time liquid effluent monitoring will not be required for the PUREX Plant. Until more sensitive equipment is developed and procured, compliance with discharge criteria shall be determined by sampling methodology as provided by the DOE.

7.2.4 Liquid Effluent Sampling Program

The sampling program for liquid effluent shall include composite and grab sampling methods. Samples shall be analyzed for major cations, major anions, pH, metals, volatile organic chemicals, and extractable organic chemicals. The sampling and analytical plan is summarized in Table 7-6.

7.2.4.1 CSL Effluent Stream. The CSL composite sampling equipment is located in the 295-AC Building. During stream operation, a 7-day composite sample shall be collected weekly and recomposited monthly for radiochemical and metals analyses in accordance with WHC-CM-7-5 (WHC 1991a). In addition, the pH of the CWL stream shall be determined from each weekly composite sample.

Grab samples shall be collected quarterly. The grab sample shall be analyzed for pH, major cations, major anions, metals, radionuclide, and organic chemical concentrations.

During the first and third quarter, a complete gas chromatography/mass spectrometry (GC/MS) analysis of the effluent shall be performed, using analytical techniques that are comparable to EPA-SW 846 Method 8270 (EPA 1986) for detection capability. During the second and fourth quarters, organic analyses shall only include GC methods, comparable to EPA-SW 846 Methods 8010 and 8020 (EPA 1986), for determination of volatile organic chemicals. If four consecutive quarterly analyses show that organic chemicals are below detection limits, the sampling and analytical requirements for organic chemicals may be reevaluated for reduction in scope.

7.2.4.2 Diverted Effluent. Upon receipt of a HIGH RADIATION alarm form the CSL gamma monitor, an additional sample shall be collected using the equipment provided for verification sampling of the CSL.

Samples collected during and immediately after the HIGH RADIATION alarm event shall be analyzed for radionuclides. After a diversion, the 216-A-42 Basin will be recirculated and sampled per procedure. Assuming the initial sample results meet acceptable criteria, the basin will be pumped to the 216-B-3 Pond. Before pumping the basin, additional samples will be taken for environmental release recordkeeping.

Table 7-1. Radioactive Sampling Requirements for the Plutonium-Uranium Extraction Plant During Standby.*

Stack	Sampling/analysis requirements*	
	Total alpha/beta	Individual radionuclide(s)
291-A-1	Yes	^{90}Sr ^{239}Pu
296-A-1	Yes	^{239}Pu ^{241}Am
296-A-2	No	None
296-A-3	No	None
296-A-5A/5B	No	None
296-A-6	No	None
296-A-7	No	None
296-A-8	No	None
296-A-10	No	None
296-A-14	No	None

*Based on CFR (EPA 1989a).

Table 7-2. Current Monitoring and Sampling.*

Constituent	Time period	Sampling analytical limit (μCi/mL)	Required detection limit (μCi/mL)
Total Alpha	Annual Avg.	5.0 E-15	6.1 E-15
Total Beta	Annual Avg.	4.0 E-14	2.4 E-12
^{90}Sr	Annual Avg.	2.0 E-14	2.4 E-12
^{239}Pu	Annual Avg.	1.0 E-14	6.2 E-15
^{241}Am	Annual Avg.	6.0 E-15	6.1 E-15

*Calculated from NESHAP Standards (EPA 1989a) for required monitoring.

Table 7-3. Monitoring/Sampling and Analysis Program for Air Effluents.

Monitor/sample location	Analytes	Sample frequency	Type of event	Equipment type
Stack 291-A-1				
RM-V19-3[1] (60-ft)	Alpha, beta	Continuous	M	CPRM[2]
SPL-V18-1 (74-ft)	^{90}Sr, ^{239}Pu	Weekly	S	Record Sampler
SPL-V19-1 (60-ft)	^{90}Sr, ^{239}Pu	Weekly	S	Record Sampler
Stack 296-A-1				
RM-V29A-1	Alpha	Continuous	M	Eberline Alpha CAM
SPL-V28A-1	^{239}Pu, ^{241}Am	Weekly	S	Record Sampler

[1]Moving Filters Radiological Aerosol Monitor; will be deactivated during PUREX standby and replaced with annual average method.
[2]Continuous Particulate Release Monitor.

Table 7-4. Comparison of the Plutonium-Uranium Extraction Plant Liquid Effluent Qualities[1] and State Approved Land Disposal Structure Acceptance Criteria. (4 sheets)

Analyte	Acceptance criterion	CSL Routine
Inorganic Compounds - Metals[3]		
Aluminum	50	341
Antimony	5	
Arsenic	50	
Barium	1,000	34
Beryllium	1	
Boron	NC	22
Cadium	5	
Calcium	NC	1.9 E+04
Chromium	50	
Copper	1,000	40
Iron	300	443
Lead	5	6
Magnesium	NC	4,350
Manganese	50	30
Mercury	2	0.1
Nickel	100	
Potassium	NC	740
Selenium	10	
Silicon	NC	2,910
Silver	50	
Sodium	NC	2,160
Strontium	NC	95
Thallium	1	
Uranium	NC	0.6
Zinc	5,000	25

Table 7-4. Comparison of the Plutonium-Uranium Extraction Plant Liquid Effluent Qualities[1] and State Approved Land Disposal Structure Acceptance Criteria. (4 sheets)

Analyte	Acceptance criterion	CSL Routine
Inorganic compounds - Ionic Species[3]		
Ammonium	NC	63
Chloride	2.5 E+05	1.8 E+03
Cyanide	200	
Fluoride	2,000	154
Fluoride (IC)[4]	NC	
Fluoride (ISE)[4]	NC	
Nitrate	10,000	588
Nitrate	1,000	
Sulfate	2.5 E+05	1.3 E+04
Organic Compounds[3]		
Acetone	NC	
1-Butanol	NC	
2-Butanone	NC	
Butylated		
Hydroxytoluene	NC	10
Chloroform	6	
Dibutyl phosphate	NC	
Dichloromethane	5	
Tributylphosphate	NC	
Other Parameters[3]		
Alkalinity	NC	6.6 E+04
Conductivity (μS)	NC	158
pH (dimensionless)	6.5-8.5	7.8
TDS[4]	5.0 E+05	6.5 E+04
Temperature (°C)	NC	28
TOC[4]	NC	

Table 7-4. Comparison of the Plutonium-Uranium Extraction Plant Liquid Effluent Qualities[1] and State Approved Land Disposal Structure Acceptance Criteria. (4 sheets)

Analyte	Acceptance criterion	CSL Routine
Other Parameters[3] (continued)		
Total Carbon	NC	1.5 E+04
TOX[4] (as Cl)	NC	99
Radionuclides[d]		
Total Alpha	15	1
Total Beta	20	2
^{226,228}Ra	5.0 E+00	<1.9 E-01
Gross uranium-natural	2.4 E+01	4.9 E+02
^{3}H	2.0 E+01	4.9 E+02
^{14}C		4.28 E+00
^{90}Sr	8.0 E+00	
^{129}I	2.0 E+01	
^{137}Cs	1.2 E+02	4.6 E-01
^{144}Ce/Pr	2.8 E+02	
^{147}Pm	8.0 E+04	
^{234}U	2.0 E+01	1.9 E-01
^{238}Pu	1.6 E+00	1.6 E-02
^{238}U	2.4 E+01	1.6 E-01
^{239,240}Pu	1.2 E+00	5.3 E-01
^{239,240}U	1.2 E+03	
^{241}Am	1.2 E+00	2.0 E-01
Stream-Specific Report (WHC 1990a) Addendum Number		Addendum 2
Approximate Average Flow Rate (L/mo)		7.7 E+07
Estimated Flow Rate for PUREX Shutdown Condition (L/mo)		5.0 E+07

Table 7-4. Comparison of the Plutonium-Uranium Extraction Plant Liquid Effluent Qualities[1] and State Approved Land Disposal Structure Acceptance Criteria. (4 sheets)

Analyte	Acceptance criterion	CSL Routine
Estimated Flow Rate for PUREX Standby Condition (L/mo)		5.0 E+07
Discharge Point		216-B-3 Pond

[1]Analyte concentrations represented by the 90% confidence interval limit (the upper limit of the one-tailed 90% confidence interval for all data sets) as reported in the appropriate stream specific report. When a 90% confidence interval limit was not estimated, the maximum observed result is listed.

[2]Effluent concentrations expressed as micrograms per liter unless indicated otherwise.

[3]Effluent concentrations for radionuclides expressed as picocuries per liter.

[4]Abbreviations used:

TDS = total dissolved solids
TOC = total organic carbon
TOX = total organic halides
MS = microsiemen
IC = fluoride analysis using ion chromatography technique
ISE = fluoride analysis using ion-specific electron technique.

Table 7-5. Chemical Sewer Normal Operating Parameters.

Parameter	Measurement unit	Parameter range		Monitor identification
		Low value	High value	
Gamma	cpm	0	6,500	RR-W20-2-1
pH	Unitless	5.0	11.0	NE-W20-19-1
Total Alpha	μCi/mL	0	2.0 E-05	Laboratory Analyses
Total Beta	μCi/mL	0	1.2 E-06	Laboratory Analyses
^{3}H	μCi/mL	0	1.2 E-02	Laboratory Analyses
^{90}Sr	μCi/mL	0	1.2 E-02	Laboratory Analyses
^{137}Cs	μCi/mL	0	8.0 E-05	Laboratory Analyses
Flow	gal/min	1	1,400	FR-W20-1-1

Table 7-6. Sampling Analysis Program for Chemical Sewer Stream.

Sample location	Waste stream	Analytes	Sample frequency	Sample type	Analytical technique
295-AC	CSL	pH, Metals, Radionuclides	Monthly	C	Liquid Scintillation, ICP
Manhole 4	CSL	pH, Metals, Radionuclides, VOC, EOC, Major Ions	First and Third Quarters	G	Liquid Scintillation, IC, GC/MS, ICP, Wet Chemistry
			Second and Forth Quarters	G	Liquid Scintillation, GC, ICP, Wet Chemistry
295-AC	Diverted Effluent	Radionuclides	Hourly during alarm and daily composite for 7 d after diversion ceases	G,C	Liquid Scintillation

C = composite
EOC = base-neutral-acid extractable organic compounds
G = grab
IC = ion chromatography
GC = gas chromatography
ICP = inductively-coupled plasma atomic emission spectroscopy
MS = mass spectroscopy
VOC = volatile organic compounds.

8.0 HISTORICAL MONITORING/SAMPLING DATA FOR EFFLUENT STREAMS

8.1 AIR EFFLUENTS

8.1.1 Normal Conditions

Historical air effluent M/S data have been assembled in annual reports. These reports typically record the routine releases, unusual occurrences (i.e., upset conditions), sample points, analytical data sheets, instrument calibration records, and other information. The last seven annual reports are listed below, but only the 1990 annual report data were collected during standby conditions. PUREX is now in standby condition and will remain so until a projected 1997 restart or the initiation of terminal cleanout operations.

Annual Reports

1985 *Rockwell Hanford Operations Annual and Environmental Surveillance Report for 1985*, RHO-HS-SR-85-13P, Rockwell Hanford Operations, Richland, Washington.

1986 *Rockwell Hanford Operations Annual and Environmental Surveillance Report for 1986*, RHO-HS-SR-86-13P, Rockwell Hanford Operations, Richland, Washington.

1987 *Westinghouse Hanford Company Environmental Surveillance Report for 1987*, WHC-EP-0145, Westinghouse Hanford, Richland, Washington.

1987 *Westinghouse Hanford Company Effluent Discharge and Solid Waste Management Report for Calendar Year 1987: 200/600 Areas*, WHC-EP-0141, Westinghouse Hanford. Richland, Washington.

1988 *Westinghouse Hanford Company Effluent Discharge and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas*, WHC-EP-0141-1, Westinghouse Hanford, Richland, Washington.

1989 *Westinghouse Hanford Company Effluent Discharge and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, WHC-EP-0141-2, Westinghouse Hanford, Richland, Washington.

1992, *Environmental Releases for Calender Year 1990*, WHC-EP-0527, Westinghouse Hanford, Richland, Washington.

Pertinent information on the historical gaseous effluent monitoring may also be found in the following document.

1990 *Effluent Monitoring Plan PUREX Gaseous Effluents*, SD-CP-EMP-004, Westinghouse Hanford, Richland, Washington.

8.1.2 Upset Conditions

Section 4.1.3 describes upset operating conditions of each stack.

8.2 LIQUID EFFLUENTS

8.2.1 Normal Conditions

Historical liquid M/S data have been assembled in various reports. The four Effluent Releases and Solid Waste Management Reports for 1987, 1988, 1989, and 1990 in Section 8.1.1 list much of this information. Routine operations and releases, upsets, sample points, analytical data sheets, and other information are typically recorded. The following reports contain additional historical data and standby condition data.

- 1990, *PUREX Liquid Effluent Monitoring Plan*, WHC-SD-CP-EMP-006, Westinghouse Hanford Company, Richland, Washington.
- 1990, *Stream Specific Reports*, WHC-EP-0342, Addenda 1-33, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 2, *PUREX Plant Chemical Sewer Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 5, *PUREX Plant Steam Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 12, *PUREX Plant Process Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 14, *PUREX Plant Ammonia Scrubber Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 20, *PUREX Plant Cooling Water Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.

8.2.2 Upset Conditions

Section 4.2.3 describes upset operating conditions of each liquid discharge.

9.0 SAMPLE ANALYSIS

9.1 ANALYTICAL LABORATORY AND PROCEDURES

Requirements for the development, issuance, and control of instructions and procedures within the Analytical Labs are covered by WHC-CM-5-4, *Analytical Chemistry Services Laboratories Operating Instructions* (WHC 1988d). This procedure is an administrative procedure which provides guidance on how to write, review, and control analytical procedures and other supporting procedures used within the analytical laboratories.

The analytical laboratories presently have over 1,000 procedures that define operations. These procedures, individually numbered and controlled, are divided into six categories.

1. **LA Series--Analytical Procedures.** These procedures cover a specific analysis or analysis type for each sample.

2. **LO Series--Operating Procedures.** These procedures provide guidance for all lab operations supporting analytical techniques. This would include such operations as packaging, shipping, etc.

3. **LE Series--Essential Materials Procedures.** These procedures cover the analysis of supplies, chemicals, metals, etc. using industry standard analyses such as ASTM procedures.

4. **LR Series--Reagent Procedures.** These procedures provide guidance for the preparation, dilution and storage of standards and reagents used in specific analytical procedures (LA Series).

5. **LC Series--Computer Operation Procedures.** These procedures cover the use of database systems and computer operations associated with specific analysis techniques.

6. **LQ Series.** These procedures cover the techniques used for QC guidance, calibration, and verification of analysis techniques and analytical systems.

Each Analytical procedure (LA Series) covers a specific analysis for a variety of sample types. The procedures are individually numbered, issued and controlled by the Procedure Control Group. Each procedure is a "controlled" document and contains the following:

- Title
- Author
- Issued By
- Laboratory Manager
- Release Date
- Review Date
- Document Number
- Revision/Modification
- Page Number.

Each procedure contains the following generic sections as applicable to the specific analysis technique:

- Summary
- Limitations
- Application
- Safety
- Reagents
- Equipment
- Standards
- Procedure Steps
- Calculations
- Discussion
- References.

Additional requirements are defined in *PUREX/UO_3 Plant Administration*, WHC-CM-5-9 (WHC 1990h). These procedures define operations not covered by existing codes and standards and contain all necessary requirements for qualifying personnel, procedures, and/or equipment to conduct processes in a timely, competent manner. Analytical Laboratory operating instructions also cover the preparation, documentation, and control of individual procedures.

Quality Assurance requirements for the Analytical Laboratory procedures are defined by the following documents:

- WHC-CM-4-2, *Westinghouse Quality Assurance Manual* (WHC 1988e)

- WHC-CM-5-9, *PUREX/UO_3 Plant Administration* (WHC 1990h)

The 222-S Laboratory on the Hanford Site has one program plan and two project plans to address applicable quality requirements related to sample analysis. These plans are as follows:

- WHC-SD-CP-QAPP-003, *Quality Assurance Program Plan for the Chemical Analysis of Environmental Samples* (WHC 1990i)

- WHC-SD-CP-QAPP-001, *Analytical Chemistry Services Laboratories Quality Assurance Plan* (WHC 1989b)

- WHC-SD-CP-QAPP-002, *Quality Assurance Project Plan for the Chemical Analysis of Highly Radioactive Mixed Waste Samples in Support of Environmental Activities on the Hanford Site* (WHC 1989d).

The *Resource Conservation and Recovery Act of 1976* (RCRA) protocol liquid effluent sampling, associated with the liquid effluent study, is not part of the FEMPs. The QA requirements for the sampling analysis plans (SAP) associated with the liquid effluent study are identified in the latest version of the WHC-SD-WM-QAPP-011, *Liquid Effluent Sampling Quality Assurance Project Plan* (WHC 1991d).

Details of the analytical laboratory and analytical procedures are discussed in the 222-S Laboratory FEMP.

The analytical and laboratory procedure for the FEMP activities are identified in the *Quality Assurance Project Plan for Facility Effluent Monitoring Plan* (WHC 1992b). General requirements for laboratory procedures, data analyses, and statistical treatment are addressed in the Quality Assurance Project Plan (QAPjP).

The following elements are identified in the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991) (Tables 9-1 and 9-2).

9.2 SAMPLE AND DATA CHAIN OF CUSTODY

Sample identification is initiated by the operations group taking the sample. Sampling personnel use the chain of custody form and "log in" system to provide sample identification. Sample custody is transferred when the properly marked sample is received by the analytical laboratory.

Sample chain of custody within the analytical laboratory is covered by WHC-CM-5-4, *Analytical Chemistry Services Laboratories Operating Instructions* (WHC 1988d) and individual analytical laboratory procedures.

The PUREX Plant has no formal chain of custody procedure. A formal chain of custody procedure similar to EII-5.1 "Chain of Custody" from WHC-CM-7-7 (WHC 1989c) should be adopted.

Because the Hanford Site has 33 separate discharges, the Tri-Party Agreement has established milestones as part of the Liquid Effluent Study program for compliance plans of liquid discharges to land that could infiltrate to groundwater (Ecology, et al 1991). Sampling and analysis plans (SAP) are required for each Hanford Site liquid effluent stream. A SAP for PUREX, *PUREX CSL Sampling and Analysis Plan* was prepared in September 1991 (WHC 1991c). The SAP describes the sampling, analysis, and related activities required under the Tri-Party Agreement for PUREX liquid effluent streams.

Sampling will be performed according to the SAP. The SAPs have been prepared pursuant to the Tri-Party Agreement (Ecology et al. 1991) and are available for review.

Table 9-1. Laboratory Procedures.

Element	Documentation
Sample identification system	To be provided when complete
Procedures preventing crosscontamination	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Documentation of methods	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Gamma emitting radionuclides	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Calibration	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Handling of samples	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Analysis method and capabilities	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Gross alpha, beta, and gamma measurements	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Direct gamma-ray spectrometry	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Beta counters	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Alpha-energy analysis	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Radiochemical separation procedures	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)
Reporting of results	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table 8-1)

Table 9-1. Laboratory Procedures.

Element	Documentation
Counter calibration	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table B-1)
Intercalibration of equipment and procedures	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP WHC-EP-0446 Table B-1)
Counter background	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP, WHC-EP-0446 Table 8-1)
Quality assurance	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP, WHC-EP-0446 Table 8-1)

QAPjP = Quality Assurance Project Plan.

Table 9-2. Data Analyses and Statistical Treatment.

Element	Documentation
Summary of data and statistical treatment requirements	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP, WHC-EP-0446 Table 8-1)
Variability of effluent and environmental data	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP, WHC-EP-0446 Table 8-1)
Summarization of data and testing for outliers	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP, WHC-EP-0446 Table 8-1)
Treatment of significant figures	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP, WHC-EP-0446 Table 8-1)
Parent-decay product relationships	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP, WHC-EP-0446 Table 8-1)
Comparisons to regulatory or administrative control standards and control data	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP, WHC-EP-0446 Table 8-1)
Quality assurance	Contained in 222-S Laboratory Analytical Procedures (identified in QAPjP, WHC-EP-0446 Table 8-1)

10.0 NOTIFICATION AND REPORTING REQUIREMENTS

Notification and reporting requirements are imposed by federal and state law as well as by DOE orders. Because DOE and EPA documents are periodically updated, the current requirements should be obtained from the latest CFR, DOE order, etc. This section is to serve as a guideline for general notification and reporting requirements and as a reference to the sources where specific information may be found for federal, state, and DOE requirements.

10.1 FEDERAL REQUIREMENTS

10.1.1 Resource Conservation and Recovery Act of 1976

The RCRA requires biennial reports to be submitted to the regional administrator of EPA. The 40 CFR 262, Subpart D (EPA 1988c), sets forth the reporting requirements for generators of hazardous waste that ship waste offsite or that store, treat, or dispose of hazardous waste onsite.

Owners or operators of treatment, storage, or disposal (TSD) facilities must comply with the reporting requirements contained in 40 CFR 264, Subpart E (EPA 1988a), and 40 CFR 265, Subpart E (EPA 1988b).

10.1.2 Comprehensive Environmental Response, Compensation, and Liability Act of 1980

The 40 CFR 302 (EPA 1989c) contains reportable quantities and notification requirements for releases of hazardous substances as designated by CERCLA and the *Clean Water Act of 1977*.

10.1.3 National Emission Standards for Hazardous Air Pollutants

Compliance and reporting requirements for DOE facilities emitting radionuclides other than Radon are contained in 40 CFR 61, Subpart H (EPA 1989a). The NESHAP requires that an annual report be submitted to EPA headquarters and the appropriate regional office.

10.2 STATE REQUIREMENTS

10.2.1 Generator Reporting

Generator reporting requirements are found in WAC 173-303-220 (WAC 1987a). The state requires that annual reports covering the preceding year be submitted by March 1 to Ecology.

10.2.2 Facility Reporting

Owners or operators of TSD facilities are also required to prepare and submit annual reports. These reports also must be submitted by March 1 and cover facility activities for the previous year. The specific content requirements are in WAC 173-303-390 (WAC 1987a).

Effluents from PUREX in the standby mode do not contain hazardous or dangerous wastes; therefore, PUREX operations are not subject to RCRA or WAC 173 reporting requirements. Westinghouse Hanford would only have to comply with the above federal and state reporting requirements if the facility operations change and discharges (either liquid or gaseous) from the PUREX facility contain a hazardous or dangerous component.

10.3 U.S. DEPARTMENT OF ENERGY REQUIREMENTS

10.3.1 U.S. Department of Energy Order 5400.1, Chapter II General Environmental Protection Program - Notification and Reports

Consistent with the notification requirements contained in DOE Orders 5484.1 (DOE 1983), 5000.3A (DOE 1990b), and the DOE 5500 series, field organizations shall notify the Emergency Operations Center (EOC) of the significant nonroutine releases of any pollutant or hazardous substance.

All DOE facilities that conduct significant environmental protection programs shall prepare an Annual Site Environmental Report. Annual summary reports on environmental occurrences shall be included in the Annual Site Environmental Report. Suggested content and format for the Annual Site Environmental Report are contained in DOE Order 5400.1 (DOE 1988a).

The DOE Order 5400.1 also requires that a Radioactive Effluent and Onsite Discharge Data Report, covering the previous calendar year, be submitted to the Waste Information Systems Branch, EG&G Idaho, in Idaho Falls, Idaho 83415, by April 1. Unplanned releases of radioactive material in effluents, whether onsite or offsite, shall also be reported. The content and forms to be used for these reports are contained in DOE Order 5400.1, Chapter II.

10.3.2 U.S. Department of Energy Order 5484.1 Environmental Protection, Safety, and Health Protection Information Reporting Requirements

Annual Radiation Exposure Reports are required to be submitted to the System Safety Development Center by March 31 for the preceding calendar year. Content and form requirements are in Chapter IV of this order.

The DOE Order 5484.1 also requires radiation exposures of individuals that exceed the specified limits in one calendar quarter to be reported in the form of a memorandum to the Operational and Environmental Safety Division. Radiation exposure limits are listed in Chapter II of this order.

Events that occur in the facility and adversely affect operations, personnel safety, or DOE requirements should receive a thorough investigation and an investigation report should be prepared. The DOE Order 5484.1 (DOE 1983) sets forth occurrences requiring investigation as well as the investigation requirements as determined by the severity of the occurrence, investigation report format, and content outlines.

The RL Order 5484.1 contains the following requirements for the implementation of DOE Order 5484.1 at the Hanford Site. Contractors shall, at a minimum, make oral notification to the appropriate RL program division or office, to Public Affairs Office (PAO) and to Safety and Quality Assurance (SQA) or the SQA duty officer as soon as it is apparent that an incident may meet the criteria of a Type A or Type B occurrence. For a listing of occurrences requiring a Type A or Type B investigation see Chapter I of DOE Order 5484.1.

Contractors are required to verbally notify responsible SQA environmental protection officials within 24 h of becoming aware of any of the following occurrences.

- Violation of applicable federal, state, or local pollution control standards and requirements.
- Any noncompliance with the terms and/or conditions of an existing National Pollutant Discharge Elimination System (NPDES) permit, PSD permit, or any other environmental protection based permit or formal agreement with an applicable regulatory body.
- Any gaseous or liquid radiological effluent releases that exceed DOE requirements and/or contractor specific radiological release concentration guides.

Following verbal notifications, written reports must be submitted according to procedures in DOE Order 5000.3A (DOE 1990b).

10.3.3 U.S. Department of Energy Order 5000.3A Occurrence Reporting and Processing of Operations Information

This order sets forth notification and follow-up requirements for a variety of reportable occurrences. Categorization or reportable occurrences should be made as soon as possible. Guidance to categorization and definitions can be found in Section 7.0 of this order.

Emergency occurrences must be reported to DOE and offsite authorities within 15 min or less of categorization. Written notification must be made within 24 h.

Unusual occurrences must be reported to DOE within 2 h of categorization. Written notification shall be made within 24 h.

Off-normal occurrences must be reported via written notification within 24 h of categorization.

In addition, follow-up oral notification shall also be made to DOE if any further degradation in the level of safety of the facility or other worsening conditions occur, when there is any change from one emergency action level to another, or upon termination of an emergency.

11.0 INTERFACE WITH THE OPERATIONAL ENVIRONMENTAL SURVEILLANCE PROGRAM

11.1 DESCRIPTION

The sitewide Environmental Monitoring Plan (EMP), as described in the FEMP Management Plan (WHC 1991b), consists of two distinct but related components: environmental surveillance conducted by Pacific Northwest Laboratory (PNL) and effluent monitoring conducted by Westinghouse Hanford. The responsibilities for these two portions of the EMP are delineated in a Memorandum of Understanding (PNL 1989). Environmental surveillance, conducted by PNL, consists of surveillance of all environmental parameters to demonstrate compliance with regulations. Effluent monitoring includes both in-line and facility effluent monitoring as well as near-facility operational environmental monitoring. Projected EDEs reported in this FEMP are the products of in-line effluent monitoring. Near-field monitoring is required by Part O, "Environmental Monitoring," *Environmental Compliance Manual* (WHC 1991a), and procedures are described in *Operational Environmental Monitoring* (WHC 1988f).

11.2 PURPOSE

Near-facility operational environmental monitoring is to determine the effectiveness of environmental controls in preventing unplanned spread of contamination from facilities and sites managed by Westinghouse Hanford under the approval of DOE. Effluent monitoring and reporting, monitoring of surplus and waste management units, and monitoring near-field environmental media are, therefore, conducted by Westinghouse Hanford for the purposes of controlling operations, determining the effectiveness of facility effluent controls, measuring the adequacy of containment at waste transportation and disposal units, detecting and monitoring upset conditions, and evaluating and upgrading effluent monitoring capabilities.

11.3 BASIS

Near-facility environmental surveillance is conducted to (1) monitor employee protection; (2) monitor environmental protection; and (3) ensure compliance with local, state, and federal regulations. Compliance with parts of DOE Orders 5400.1, *General Environmental Protection Program* (DOE 1988a); 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1990a); 5484.1, *Protection, Safety, and Health Protection Information Reporting System* (DOE 1983); 5820.2A, *Radioactive Waste Management* (DOE 1988b); and DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991), are addressed through this activity.

11.4 MEDIA SAMPLED AND ANALYSES PERFORMED

Procedure protocols for sampling, analysis, data handling, and reporting are specified in WHC-CM-7-4. Media include ambient air, surface water, groundwater, external radiation dose, soil, sediment, vegetation, and animals at or near active and inactive facilities and/or waste sites. Parameters monitored include the following, as needed: pH, water temperature, radionuclides, radiation exposure, and hazardous constituents. Animals that are not contaminated, as determined by a field instrument survey, are released at the capture location.

11.5 LOCATIONS

Samples are collected from known or suspected effluent pathways (e.g., downwind of potential releases, liquid streams, or proximal to release points). To avoid duplication, Westinghouse Hanford relies upon existing sample locations where PNL has previously established sample sites (e.g., air samplers in the 300 Area). There are 38 air samplers (4 in the 100 Area and 34 in the 200/600 Areas), 35 surface water sample sites (22 in the 100 Area and 13 in the 200/600 Areas), 110 groundwater monitoring wells (20 in the 100 Area, 89 in the 200/600 Areas, and 1 in the 300/400 Areas), 299 external radiation monitor points (182 survey points and 41 thermoluminescent dosimeter (TLD) sites in the 100 Area, 61 TLD sites in the 200/600 Areas, and 15 TLD sites in the 300/400 Areas), 157 soil sample sites (32 in the 100 Area, 110 in the 200/600 Areas, and 15 in the 300/400 Areas), and 95 vegetation sample sites (40 in the 100 Area, 40 in the 200/600 Areas, and 15 in the 300/400 Areas). Animal samples are collected at or near facilities and/or waste sites. Specific locations of sample sites are found in WHC-CM-7-4 (WHC 1988f).

Additionally, surveys to detect surface radiological contamination, scheduled in WHC-CM-7-4, are conducted near and on liquid waste disposal sites (e.g., cribs, trenches, drains, retention basin perimeters, pond perimeters, and ditch banks), solid waste disposal sites (e.g., burial grounds and trenches), unplanned release sites, tank farm perimeters, stabilized waste disposal sites, roads, and firebreaks in the Operations Areas. There are 391 sites in the Operations Areas (100 in the 100 Area, 273 in the 200/600 Areas, and 18 in the 300/400 Areas) where radiological surveys are conducted.

11.6 PROGRAM REVIEW

The operational environmental monitoring program will be reviewed at least annually to determine that the appropriate effluents are being monitored and that the monitor locations are in position to best determine potential releases.

11.7 SAMPLER DESIGN

Sampler design (e.g., air monitors) will be reviewed at least biannually to determine equipment efficiency and compliance with current EPA and industry [e.g., ANSI and American Society for Testing and Materials (ASTM)] standards.

11.8 COMMUNICATION

The Operations and Engineering Contractor and the Research and Development Contractor will compare and communicate results of their respective monitoring programs at least quarterly and as soon as possible under upset conditions.

11.9 REPORTS

Results of the near-facility operational environmental monitoring program are published in the *Westinghouse Hanford Company Environmental Surveillance Annual Report* (WHC 1988g). The radionuclide values in these reports are expressed in curies, or portions thereof, for each radionuclide per unit weight of sample (e.g., picocuries per gram) or in field instrument values (e.g., counts per minute) rather than EDE, which is calculated as the summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor.

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12.0 QUALITY ASSURANCE

12.1 PURPOSE

The QAPjP (WHC 1992) describes the QA requirements associated with implementing FEMPs. The plan identifies the FEMP activities and assigns the appropriate QA requirements defined by the Westinghouse Hanford *Quality Assurance Manual*, WHC-CM-4-2 (WHC 1988e). This QAPjP shall be consistent with the requirements in DOE 5700.6C, "Quality Assurance" (DOE 1991a). In addition, QA requirements in 40 CFR 60, Appendix A, "Reference Methodologies" (EPA 1990) and 40 CFR 61, Appendix B, Method 114 shall be considered when performing monitoring calculations and establishing monitoring systems for airborne emissions.

12.2 OBJECTIVE

The objective of the plan is to provide a documented QA plan describing QA requirements for facilities implementing the FEMPs.

12.3 REQUIREMENTS

A QAPjP (WHC 1992b) has been developed to implement the overall QA program requirements defined by WHC-CM-4-2 and 40 CFR 61, Method 114, Appendix B (EPA 1989a). The QAPjP applies specifically to the field activities, laboratory analyses, and continuous monitoring performed for all FEMPs conducted by Westinghouse Hanford. Plans and procedures referenced in the QAPjP are available for regulatory review upon request by the direction of the Westinghouse Hanford Environmental Assurance Manager. A QAPP for radioactive airborne emissions was prepared (Vance 1991) to address the QA elements of 40 CFR 61 and was submitted to the EPA.

12.4 FACILITY SPECIFIC REQUIREMENTS

The QAPjP includes a list of analytes of interest and analytical methods for RCRA groundwater monitoring at the Hanford Site SALDS criteria.

A facility-specific QA plan will be provided when available, and it will be incorporated into the next revision.

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13.0 INTERNAL AND EXTERNAL PLAN REVIEW

The DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988a), Chapter IV.4 requires the facility effluent monitoring plan be reviewed annually and updated every 3 yr. The FEMP should be reviewed and updated as necessary after each major change or modification in the facility processes, facility structure, ventilation and liquid collection systems, monitoring equipment, waste treatment, or a significant change to the Safety Analysis Reports. In addition, EPA regulations require that records on the results of radioactive airborne emissions monitoring be maintained onsite for 5 yr. Operations management shall maintain records of reports on measurements of stack particulates or other nonradioactive hazardous pollutant emissions for 3 yr.

Facility operators will have to certify on a semiannual basis that no changes in operations that would require new testing have occurred. Although the report is based on the calendar year, the emission limits apply to any period of 12 consecutive months. Westinghouse Hanford Environmental Protection prepares an annual effluent discharge report for each area on the Hanford Site to cover both airborne and liquid release pathways. In addition, a report on the air emissions and compliance to the NESHAP is prepared by Environmental Protection and submitted to EPA as well as DOE Headquarters.

Facility management is to obtain the environmental protection function's approval for all changes to the FEMPs, including those generated in the annual review and update. In addition, the FEMP shall be reviewed by QA and Regulatory Analysis.

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14.0 COMPLIANCE ASSESSMENT

A comparison of M/S system capabilities to regulatory and other requirements was completed to determine which areas were not in compliance. This section summarizes that comparison. A detailed point by-point evaluation of the NESHAP requirements (EPA 1991) is included in Table 14-1.

14.1 COMPLIANCE ASSESSMENT

14.1.1 Comparison of Instrument Specifications with Required Standard

The existing air effluent M/S system of near isokinetic continuous sampling with periodic analysis of the resultant samples complies with 40 CFR 61, Subpart H. For Stacks 291-A-1 and 296-A-1, EPA flow measurement requirements for continuous sampling are not met. Laboratory analysis and chain-of-custody procedures are adequate to maintain sample accuracy and reliability. All QA documentation to ascertain full compliance with 40 CFR 61 (EPA 1989a) is not available. However, many of the QA elements are addressed in the *Quality Assurance Project Plan for Radionuclide Airborne Emissions Data Compliance and Reporting*, submitted to the EPA (WHC 1992).

Current water effluents are periodically sampled and analyzed. This technique meets established standards for discharge to 216-B-3 Pond and 216-A-30 and 216-A-37-2 Cribs. Future discharge to a SALDS will be under a negotiated permit. Comparison to as-yet-to-be-defined discharge criteria which are the result of the negotiation process is not possible.

14.1.2 Comparison of Instrument Specifications with Monitoring Criteria

The current air monitoring systems with its capability of continuous, near isokinetic sampling followed by periodic analyses achieve full compliance with monitoring criteria. Water effluent monitoring criteria of flow, pH and chemical composition are also fully met by the existing M/S system.

14.1.3 Comparison of Instrument Specifications with Effluent Characteristics

Existing monitoring equipment for both the air and water effluent streams has the capability to accurately characterize the stream's general parameters such as flow rate, loss of flow, temperature, pH, etc. These general parameters are also appropriate to indicate changes in the effluents. Laboratory analysis can be selected to characterize any desired effluent parameter.

14.1.4 Comparison of Projected Effluent Characteristics with Historical Data

Historical data used to project effluent characteristics throughout this FEMP were edited so that only data representing standby conditions were used. Therefore, the projected characteristics are the same as the selected historical effluent data.

14.1.5 Comparison of Effluent Monitoring Capabilities with Regulatory and Contractor Requirements

Effluent monitoring capabilities for both the air and water discharges meet both regulatory and Westinghouse Hanford requirements; with the exception noted in Section 14.1.1.

14.2 EXEMPTIONS

No current or pending exemptions have been identified.

14.3 SYSTEM UPGRADES REQUIRED FOR COMPLIANCE

No system upgrades are currently required; however, compliance with the intent of SALDS acceptance criteria will likely require equipment upgrades in the liquid effluent M/S system.

14.4 CLEAN AIR ACT REQUIREMENTS

The NESHAP requirements are discussed in Table 14-1.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
40 CFR 61, Subpart H [61.90-61.97], National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities			
61.92 Standard Emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.		Yes	Dose calculations for atmospheric radionuclide releases from the Hanford Site for calendar year (CY) 1990 were performed by Pacific Northwest Laboratory (PNL) using the approved U.S. Environmental Protection Agency (EPA) CAP-88 computer model. Emissions from discharge points in the Hanford Site 100, 200, 300, 400, and 600 areas were calculated based on results of analyses of continuous and periodic sampling conducted at the discharge points. These calculated emissions were provided for inclusion in the CAP-88 model by area and by individual facility for those facilities having the potential to contribute more than 10% of the Hanford Site total or to result in an impact of greater than 0.1 mrem per year to the maximally exposed individual (MEI). Also included in the assessment of offsite dose modeling are the measured radioactive emissions from all Hanford Site stacks that have routine monitoring performed. Record sampling systems have been installed on all stacks and vents that use exhaust fans to discharge air that may potentially carry airborne radioactivity. Estimation of activity from ingrowth of long-lived radioactive progeny is not included in the CAP-88 model; therefore, the Hanford Site GENII code (Napier et al. 1988) was used to supplement the CAP-88 dose calculations. When the dose to the MEI located in the Ringold area was calculated, the effective dose equivalent from combined Hanford Site radioactive airborne emissions was shown to be 9.3E-03 mrem. This value was reported in the annual air emissions report prepared for the Hanford Site (RL 1991).

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
61.93 Emission monitoring and test procedures (a) To determine compliance, radionuclide emissions shall be determined and effective dose equivalent values for the maximally exposed offsite individual calculated using EPA approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval.		Yes	Dose calculations for atmospheric radionuclide releases from the Hanford Site for CY 1990 were performed by PNL using the approved EPA CAP-88 computer model. Emissions from discharge points in the Hanford Site 100, 200, 300, 400, and 600 areas were calculated based on results of analyses of continuous and periodic sampling conducted at the discharge points. These calculated emissions were provided for inclusion in the CAP-88 model by area and by individual facility for those facilities having the potential to contribute more than 10% of the Hanford Site total or to result in an impact of greater than 0.1 mrem/yr to the maximally exposed individual. Estimation of activity from ingrowth of long-lived radioactive progeny is not included in the CAP-88 model; therefore, the Hanford Site GENII code (Napier et al. 1988) was used to supplement the CAP-88 dose calculations. When the dose to the maximally exposed individual located in the Ringold area was calculated, the effective dose equivalent from combined Hanford Site radioactive airborne emissions was shown to be 9.3E-03 mrem. This value was reported in the annual air emissions report prepared for the Hanford Site (RL 1991).
(b) Stacks shall be measured in accordance with the following requirements or other procedures for which EPA has granted prior approval: (1) Effluent flow rate measurements shall be made using the following: (i) Reference Method 2 of Appendix A to part 60 for large stacks.	Drawing H-2-55021 (WHC 1992a).	No	Based on the above drawing, the velocity measuring location used by Hanford Site Vent and Balance personnel has a cross-sectional area sufficient to be considered a large stack; therefore, Reference Method 2 applies.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
(ii) Reference Method 2A of Appendix A to part 60 for small stacks. (iii) Frequency of measurements shall depend upon the variability of the effluent flow rate. For variable flow rates, continuous or frequent flow rate measurements shall be made. For relatively constant flow rates only periodic measurements are necessary.		Equivalent	Due to the frequent fluctuations in stack flow rate, Reference Method 2 is not used. Instead, the flow is measured continuously, as described in Section 4.3.7 of Method 114.
(2) Radionuclides shall be directly monitored or extracted, collected and measured using the following: (i) Reference Method 1 of Appendix A part 60 shall be used to select monitoring or sampling sites.	See point-by-point comparison with Method 1, Section 2.1.	Yes	
(ii) The effluent stream shall be directly monitored continuously with an in-line detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance of ANSI N13.1-1969 (including Appendix A of ANSI N13.1).	See point-by-point comparison with ANSI N13.1.	Yes	
(iii) Radionuclides shall be collected and measured using procedures based on the principles of measurement described in Appendix B, Method 114 [of part 61]. Other methods must have prior approval from EPA.	See point-by-point comparison with Method 114.	Yes	
(iv) A QA program meeting Appendix B, Method 114 [of part 61] shall be conducted.	See point-by-point comparison with Method 114.	Yes	
(3) When impractical to measure as in (b)(1) or to monitor or sample as in (b)(2), see this section for further requirements. (4) (i) Measurements shall be made at all release points which have a potential to discharge radionuclides into the air in quantities which could cause an effective dose equivalent (EDE) in excess of 1% of the standard. All radionuclides which could contribute greater than 10% of the EDE shall be measured. For other release points with potential to release radionuclides, periodic confirmatory measurements shall be made.		Yes	WHC-IP-0692 indicates that this stack should be measured.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
(ii) In evaluating the potential of a release point to discharge radionuclides into the air for the purposes of this section, the estimated rad release rates shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facility operations were otherwise normal.	FEMP	Yes	Offsite dose calculations were performed on all stacks (registered with the Washington Department of Health under Permit FF-01) without pollution control equipment and using the PNL unit dose conversions. A total of seven Hanford Site stacks exceeded the 0.1-mrem criterion and will require continuous monitoring in accordance with provisions of 40 CFR 61.93(b).
(5) Environmental measurements of rad air concentrations at critical receptor locations may be used instead of air dispersion calculations if: (i) Air at point of measurement shall be continuously sampled. (ii) Major contributing radionuclides to the EDE must be collected and measured. (iii) Rad concentrations causing an EDE of 10% of the standard shall be readily detectable and distinguishable from background. (iv) Net measured rad concentrations shall be compared to the concentration levels in Table 2 of App. E [part 61] to determine compliance with the standard. In the case of multiple rads, compliance is demonstrated if the value for all rad is less than the concentration levels in Table 2, and the sum of the fractions that result when each measured concentration value is divided by the value in Table 2 for each rad is less than 1. (v) A program for quality assurance shall be conducted meeting the requirements of App. B, Method 114 [part 61]. (vi) Use of environmental measurements to demonstrate compliance with the standard if subject to prior approval of EPA.		Not applicable.	Air dispersion calculations are performed.

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APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
<u>61.94 Compliance and reporting.</u> <u>(a)</u> Compliance with this standard shall be determined by calculating the highest EDE to any member of the public at any offsite point where there is a residence, school, business, or office. Each facility shall submit an annual report to both EPA HQ and Regional by June 30 which includes monitoring results and dose calculations required by 61.43 (a) for the previous calendar year.		Yes	The Ringold location was chosen several years ago as the area where the offsite dose from all air pathways would be the highest for the MEI for the Hanford Site. The selection of Ringold was made because nearly all of the dose from air releases in recent years has been contributed by radionuclides from the Plutonium-Uranium Extraction (PUREX) Plant stack. The Ringold area is the closest farming area to the PUREX Plant, and it realistically matches the assumption that the MEI diet consists of 100% home-grown food. The Ringold area has historically been capable of producing all of the items in the MEI diet with the possible exception of cereal grain. The Ringold area lies very nearly in the path of the prevailing winds from the 200 East area. The atmospheric dispersion factor (X/Q) at Ringold is historically within 10% to 20% of the maximum offsite X/Q value associated with 200 Areas releases. The maximum value usually occurs in an adjacent sector where there is no farming. The U.S. Department of Energy Field Office, Richland (RL), provided the annual report for CY 1990 (RL 1991) to U.S. Department of Energy, Headquarters; EPA, Region X, personnel; and Washington Department of Health personnel in compliance with the regulatory deadline.
<u>(b)</u> The annual report shall also include:		Yes	(Future annual reports will also address the following requirements.)
<u>(1)</u> Name and location of facility.	RL-91-10, Pages 1-6 through 1-29. The Hanford Site summary is discussed on Pages 1-1 through 1-5.	Yes	
<u>(2)</u> List of radioactive materials used at the facility.	RL-91-10, Table 2-1 on Pages 2-2 through 2-13.	Yes	Please also refer to explanatory remarks for 40 CFR 61.93(b)(4)(i) above.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
(3) Description of handling and processing of rad materials at the facility.	RL-91-10, Pages 1-6 through 1-29.	Yes	
(4) List of the stacks and vents (or other points where radioactive materials are released to the atmosphere.	RL-91-10, Pages 1-6 through 1-29.	Yes	
(5) A description of the effluent controls that are used on each stack vent of release point, and an estimate of the efficiency of each control device.	RL-91-10, Table 2-1 on Pages 2-2 through 2-13.	Yes	
(6) Distances from the points of release to the nearest residence, school, business or office and the nearest farms producing vegetables, milk and meat.	RL-91-10, Tables 3-2, 3-3, in Section 3.	Yes	These tables show the CAP-88 Dose Estimates for the Offsite Individual at Ringold Exposed to Radionuclide Emissions from Hanford Site During 1990. Please also refer to explanatory remarks for 40 CFR 61.94 above.
(7) The values used for all other input parameters for the computer models (meteorological data) and the source of these data.	RL-91-10. Input parameters are shown in Table 2-1, Pages 2-2 through 2-13. Annual average dispersion factors around the 100, 200, 300, and 400 Areas during 1990 are given in Tables 3-5 through 3-8.	Yes	These tables use site-specific measurements of the occurrence frequencies for wind speed, wind direction, and atmospheric stability. The products of the dispersion models are annual average dispersion factors (X/Q', in units of Ci/m^3 per Ci/s or s/m^3) that, when combined with annual average release rates, will predict average radionuclide air concentrations for the year.
(8) A brief description of all construction and modifications which were completed in the calendar year for which the report is prepared, but for which the requirement to apply for approval to construct or modify was waived under 61.96.	RL-91-10, Section 3.5.2, discusses an "Application For Approval of Construction of the In Situ Vitrification Demonstration Project."	Yes	
(9) Each report shall be signed and dated by a corporate officer or public official in charge of the facility and containing a declaration of belief of accuracy and truth of the report.	RL-91-10, page 3-13, signed by John D. Wagoner, Manager, RL.	Yes	
(c) If the facility is not in compliance with the emission limits of 61.96 in the calendar year, reporting the information in (b) [above] must be done on a monthly basis starting immediately following the noncompliance annual report. Monthly reports shall also include:		Yes	Draft PUREX Plant Stack Monitoring Regulatory Comparisons for Stack 291-A-1 shows that this stack is in compliance.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
(1) Controls or other changes installed to bring the facility into compliance. (2) If the facility is under a judicial or administrative enforcement decree, the report will describe the facility performance under the terms of the decree. (d) If this information is classified, it will be made available to EPA separately and handled in accordance with regulations.		Not applicable	This information is not classified.
61.95 Recordkeeping requirements. All facilities must maintain records documenting the source of input parameters including the results of all measurements, calculations, analytical methods, and procedure for determining EDE. Sufficient information to allow an independent auditor to verify the accuracy should be kept. The records must be kept at the site for at least five years and must be made available upon request to an authorized representative.		Yes	All records and data used in the generation and verification of regulatory reports are controlled in accordance with WHC-CM-4-2, QR 4.0, "Document Control," and QR 17.0, "Quality Assurance Records."
61.96 Applications to construct or modify. In addition to construction as defined under 40 CFR 61 A, any fabrication, erection or installation of a new building or structure within a facility that emits radionuclides is also defined as new construction for purposes of 40 CFR 61 A. (b) Application for approval [61.07] or notification of startup [61.09] does not need to be filed for any new construction or modification if the EDE caused by all emissions from the new construction or modification is less than 1% of the standard of 61.92. EDE shall be calculated using the source term derived from Appendix D as input to dispersion described in 61.93. A facility is eligible for this exemption only if it is in compliance based on its last annual report. (c) Conditions to approvals granted under 61.08 will not contain requirements for post approval reporting on operating conditions beyond those specified in 61.94.		Not applicable	
61.97 Exemption from the reporting and testing requirements of 40 CFR 61.10. All facilities designated under subpart H are exempt from the reporting requirements of 40 CFR 61.10.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
40 CFR 60, APPENDIX A, REFERENCE METHOD 2, DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)			Due to frequent fluctuations in stack flow rate, Reference Method 2 is not used for demonstrating compliance. Instead, the flow is measured continuously, as described in Section 4.3.7 of Method 114. Pitot traverses are performed as a check on the accuracy of the continuous flow instrumentation.
1.0 Principle and Applicability 1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.	7-GN-56 (WHC 1991).		Average gas velocity is determined by averaging the results of exhaust duct traverses which have been conducted using a standard pitot tube and typically an Air Neotronics Limited MP Series 4 Autozero Digital Micromanometer (see description of this latter instrument in Section 2.2 below). Procedure 7-GN-56 indicates that traverse locations are determined in accordance with Section 9 of the <u>American Industrial Hygiene Association Industrial Ventilation</u> manual rather than EPA Method 1.
1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow. This procedure is not applicable at measurement sites which fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically; or (3) to move to another measurement site at which the flow is acceptable.			At the traverse location used by Vent and Balance the duct cross section is a 66 in. by 78 in. rectangle with an equivalent diameter of 6 ft. The distance between the nearest upstream and downstream disturbances is less than 50 ft. The eight- and two-diameter criterion of Method 1, Section 2.1, is, therefore, not met.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.0 Apparatus Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable. 2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g., stainless steel). It is recommended that the external tubing diameter (dimension Dt Figure 2-2b) be between 0.48 and 0.95 centimeter (3/16 and 3/8 inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions PA and PB Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3). The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
(2.1 continued) A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2: note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head ΔP reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another ΔP reading. If the ΔP readings made before and after the air purge are the same ($\pm$ 5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if ΔP at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative ΔP readings shall be taken, as above, for the last two back purges at which suitably high ΔP readings are observed.	7-GN-56		The standard pitot tube is used in conjunction with a digital micromanometer to determine stack velocities. Document 7-GN-56 does not reference procedures used to prove that pitot tube openings have plugged during velocity measurements, however, because the measurement locations are positioned downstream from high-efficiency particulate air (HEPA) filter banks, it is unlikely that plugging of tube openings occurs. Consideration will be given to modifying the procedures to include a pressure differential measurement after the last traverse.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H_2O divisions on the 0- to 1-in. inclined scale, and 0.1-in. H_2O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of ΔP values as low as 1.3 mm (0.05 in.) H_2O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all ΔP readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H_2O; (2) for traverses of 12 or more points, more than 10 percent of the individual ΔP readings are below 1.3 mm (0.05 in.) H_2O; (3) for traverses of fewer than 12 points, more than one ΔP reading is below 1.3 mm (0.05 in.) H_2O. Citation 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas velocities. As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge: (see equation 40 CFR Pt. 60 App. A, Meth. 2, page 645) If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
(2.2 continued) NOTE: If differential pressure gauges other than inclined manometers are used (e.g., magnehelic gauges) their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare ΔP readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of ΔP values in the stack. If, at each point, the values of ΔP as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured ΔP values and final results shall be used subject to the approval of the Administrator.	7-GN-56 and manufacturer's product literature.		An Air Neotronics MP Series 4 Autozero Digital Micromanometer (Air Neotronics Limited) is typically used to determine differential pressure and flow velocity. This instrument consists of a differential capacitance transducer and internal electronics that allow the instrument to calculate and display corrected velocity readings directly from pitot tube probes. Dynamic pressure signals from pitot static and total head tubes are automatically corrected within the instrument and displayed in feet per minute. The instrument is capable of resolving pressure to 0.001 in. H_2O (according to manufacturer's literature). Procedure 7-GN-56 requires that the instrument carry a current calibration sticker, traceable to NIST. No post-test series comparison against a gauge-oil manometer is indicated in Procedure 7-GN-56.
2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge, capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the Approval of the Administrator.	7-GN-56		Temperatures are not measured. The density program internal to the micromanometer described above is used to compensate for temperature. Depending on process conditions, the correction to reported velocity values derived from the actual measurement of stack gas temperatures may be minimal.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.4	Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.	7-GN-56		The static tap of a standard pitot tube is used to measure stack pressure.
2.5	Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby National Weather Service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase or vice-versa for elevation decrease.	7-GN-56		Barometric pressures are not measured. The density program internal to the micromanometer is set for standard conditions (70 °F and 29.92 in. mercury). This introduces minimal error provided the temperature of the air stream varies no more than 30 °F from standard air, the altitude of the site does not exceed 1,000 ft above sea level, or the moisture content of the air is 0.02 lb/lb of dry air or less.
2.5	Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent stack or duct diameters downstream or less than one-half duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow-sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation. NOTE: Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gal flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plant PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.			Not applicable. The measurement site is more than two equivalent duct diameters downstream and one-half equivalent duct diameter upstream from the nearest disturbances.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.6	Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.	7-GN-56		Stack gas moisture content is not determined. Depending on process conditions, however, the correction to reported velocity values derived from the actual measurement of both stack dry molecular weight and moisture content may be minimal. The PUREX Plant is presently in standby mode and moisture content will be minimal.
2.7	Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube is used as a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99 ± 0.01.	7-GN-56		Not applicable, since the Type S pitot tube is not used to measure velocity.
2.7.1	Hemispherical (shown in Figure 2- 4), ellipsoidal, or conical tip.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		The standard pitot tubes used are procured commercially from sources such as F. W. Dwyer Manufacturing Company. They are constructed to standards outlined in Section 2.7 and contain hemispherical tips.
2.7.2	A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		A minimum of six diameters straight run between tip and static pressure holes is provided.
2.7.3	A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90 degree bend.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube is provided.
2.7.4	Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piezometer ring configuration.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		The above criteria are met by the manufacturer.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.7.5 Ninety degree bend, with curved or mitered junction.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		The above criteria are met by the manufacturer.
2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in. H_2O). For multivelocity calibration, the gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in. H_2O) for ΔP values between 1.3 and 25 mm H_2O (0.05 and 1.0 in. H_2O), and to the nearest 1.3 mm H_2O (0.05 in. H_2O) for ΔP values above 25 mm H_2O (1.0 in. H_2O). A special, more sensitive gauge will be required to read ΔP values below 1.3 mm H_2O [0.05 in. H_2O] (see Citation 18 in Section 6).	7-GN-56		Not applicable. The Type S pitot tube is not used.
3.0 Procedure Procedures described in these sections shall be used to determine the stack velocity when the Type S pitot tube is used.	7-GN-56		Not applicable. The Type S pitot tube is not used

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen ΔP fluctuations. It is recommended, but not required, that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak check procedures, subject to the approval of the Administrator, may be used.			
3.2 Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-5).			
3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of ΔP values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the ΔP and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.			
3.4 Measure the static pressure in the stack. One reading is usually adequate.			
3.5 Determine the atmospheric pressure.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.6	Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO and N_2, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.			
3.7	Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.			
3.8	Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.			
4.1	Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications. After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A, and P_B, Figure 2-2b). If Dt is between 0.48 and 0.95 cm (3/16 and 3/8 in.) and if P_A, and P_B, are equal and between 1.05 and 1.50 D_t, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.1). If D_t, P_A, and P_B are outside the specified limits, the pitot tube must be calibrated as outlined in 4.1.2 through 4.1.5 below.	7-GN-56		Not applicable.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded. NOTE: Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).			
4.1.2 Calibration Setup. If the Type S Pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features: 4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters: $D_e = \frac{2LW}{(L+W)}$ 2-1 Where: D_e = Equivalent diameter L = Length W = Width To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances. NOTE: The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.			
4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to within ± 3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to within ± 5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1000 ft/min). If a more precise correlation between Cp and velocity is desired, the flow system shall have the capacity to generate at least four distinct time-invariant test-section velocities covering the velocity range from 180 and 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglass or some other transparent material.			
4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows: 4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary. 4.1.3.2 Level and zero the manometer. Turn on the fan and allow the flow to stabilize. Seal the Type S entry port.			
4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed. 4.1.3.4 Read ΔP_{std} and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port. 4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.1.3.6 Read ΔP, and enter its value in the data table. Remove the Type S pitot tube from the duct and disconnect it from the manometer. 4.1.3.7 Repeat steps 4.1.3.3 through 4.1.3.6 above until three pairs of ΔP readings have been obtained. 4.1.3.8 Repeat steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube. 4.1.3.9 Perform calculations, as described in Section 4.1.4 below.			
4.1.4 Calculations. 4.1.4.1 For each of the six pairs of ΔP readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows: $C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$ 2-2 Where: $C_{p(s)}$ = Type S Pitot tube coefficient $C_{p(std)}$ = Standard Pitot tube coefficient: use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method. ΔP_{std} = Velocity head measured by the standard pitot tube, cm H_2O (in. H_2O) ΔP_s = Velocity head measured by the Type S pitot tube, cm H_2O (in. H_2O) 4.1.4.2 Calculate C_p (side A), the mean A side coefficient, and C_p (side B), the mean B side coefficient: calculate the difference between these two average values.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.1.4.3 Calculate the deviation of each of the three A-side values of $C_p(s)$ from $\overline{C_p}$ (side A), and the deviation of each B-side value of $C_p(s)$ from $\overline{C_p}$ (side B). Use the following equation: $$Deviation = C_{p(s)} - \overline{C_p}(A \text{ or } B) \qquad 2\text{-}3$$			
4.1.4.4 Calculate α, the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation: $$\alpha(side\ A\ or\ B) = \frac{\sum_{1}^{3} \left\| C_{p(s)} - \overline{C_p}(A \text{ or } B) \right\|}{3} \qquad 2\text{-}4$$			
4.1.4.5 Use the Type S pitot tube only if the values of α (side A) and α (side B) are less than or equal to 0.01 and if the absolute value of the difference between $\overline{C_p}$ (A) and $\overline{C_p}$ (B) is 0.01 or less.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.1.5 Special considerations. 4.1.5.1 Selection of calibration point. 4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Section 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., C_p (side A) and C_p, (side B), will be valid, so long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8). 4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6 and 2-8).			
4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore, to minimize the blockage effect, the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a), the value of $C_p(s)$ depends upon the amount of free-space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or 1/4 in.) are not ordinarily used for isokinetic sampling at velocities around 915 m/min (3,000 ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).			
4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figures 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4).			
4.1.6 Field Use and Recalibration. 4.1.6.1 Field Use. 4.1.6.1.1 When a Type S pitot tube (isolated tube or assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.1.6.1.2 When a probe assembly is used to sample a small duct (12 to 36 in. in diameter), the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of $C_p(s)$. Consult Citation 9 in Section 6 for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 12 inches (Citation 16 in Section 6).			
4.1.6.2 Recalibration. 4.1.6.2.1 Isolated Pitot tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figures 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damaged to the extent that it no longer meets the specifications of Figures 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings or the tube shall be discarded.			
4.1.6.2.2 Pitot tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figures 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings or recalibrate the assembly.			
4.2 Standard pitot tube (if applicable). If a standard pitot tube is used for the velocity traverse, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of the assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).	7-GN-56 and manufacturer's product literature.		The standard pitot tube used for velocity traverses meets the criteria of Section 2.7. It is used in conjunction with a digital micromanometer. The tube coefficient (undetermined) is an integral part of the internal program used by the micromanometer to determine the pressure differential and flow velocity.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3 Temperature Gauges. After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405° C (761° F) use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either a reference thermocouple and potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be used. For temperatures above 405° C (761° F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternate reference, subject to the approval of the Administrator. If, during calibration, the absolute temperatures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.	7-GN-56		No temperature-measuring devices are used.
4.4 Barometer. Calibrate the barometer used against a mercury barometer.	7-GN-56		No barometric-pressure-measuring devices are used.
5.0 Calculations Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation. 5.1 Nomenclature. See 40 CFR Pt. 60 App. A, Meth. 2, page 657 and 658 for details).	7-GN-56 and manufacturer's product literature.		The density program internal to the digital micromanometer is used to determine stack gas velocities, which are recorded on datasheets and averaged. The volumetric flow rate is determined from the average flow velocity and sampling duct cross-sectional area.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
<u>40 CFR 60, Appendix A, Method 1, Sample and Velocity Traverses for Stationary Sources</u> 1.0 Principle and Applicability 1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas. 1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4);			This method applies. See Section 2.1 below. The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above grade, the location of the last major flow disturbance. The top of the stack is 61 m (200 ft) above the base. The sample ports are approximately 8.6, 10.6, and 12.6 diameters downstream the last major disturbance. The sample ports are approximately 20, 18, and 16 diameters upstream of the next major disturbance.
(2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m^2 (113 $in.^2$) cross-sectional area; or	Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The duct diameter is 2.1 m (7 ft).
(3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance.	Sample Point Positions: Drawing H-2-96794 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above grade, the location of the last major flow disturbance. The top of the stack is 61 m (200 ft) above the base. The duct diameter is 2.1 m (7 ft). The sample ports are approximately 8.6, 10.6, and 12.6 diameters downstream the last major disturbance. The sample ports are approximately 20, 18, and 16 diameters upstream of the next major disturbance.
The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.0 Procedure 2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation to determine the upstream and downstream distances: $D_e = \frac{2LW}{L+W}$ L+W where L = length W = width. An alternative procedure is available for determining the acceptability of a measurement location not meeting the criteria above. This procedure, determination of gas flow angles at the sampling points and comparing the results with acceptability criteria, is described in Section 2.5.	Sample Point Positions: Drawing H-2-96794 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above the base of the stack. The top of the stack is 6.1 m (200 ft) above the base. The duct diameter is 2.1 m (7 ft). The sample ports are approximately 8.6, 10.6, and 12.6 diameters downstream the last major disturbance. The sample ports are approximately 20, 18, and 16 diameters upstream of the next major disturbance.
2.2 Determining the Number of Traverse Points.			This method is required for determining the sample site, not the number of points in a traverse. Samples are collected by rake, not traverse.
2.2.1 Particulate traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.);			Eight- and two-diameter criteria met. Samples are collected by a 16-port rake, not traverse. Sample rake is described in comparison to ANSI N13.1-1969, Section A3.2 (ANSI 1969).
(2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12-24 in.);		Not applicable	The duct diameter is greater than 0.61 m (24 in).
(3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12-24 in.).		Not applicable	This stack is circular, not rectangular.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.		Not applicable	Eight and two criterion met.
2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.		Not applicable	Velocity is measured by multipoint probe, not by traverse. NOTE: Velocity probe is discussed in Method 114 Comparison, Section 4.3.7.
2.3 Cross-sectional Layout and Location of Traverse Points.		Not applicable	Not applicable. Method 1 is used for determining the sample site, not the number of points in a velocity traverse. Velocity is measured by multipoint probe, not by traverse.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown on Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2. For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to approval of the Administrator. In addition for stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 centimeters (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.		Not applicable	Method 1 is used for determining the sample site, not the number of points in a traverse.
2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points as located in Section 2.3.1 fall within 2.5 cm (1.00 in.) of the stack walls, relocate them away from the stack walls to: (1) a distance of 2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points. Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data. 2.3.1.2 Stacks With Diameters Equal to or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.		Not applicable	The diameter of this stack [0.81 m (7 ft)] is greater than 0.61 m (24 in.).

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.3.2	Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4. If the tester desires to use more than the minimum number of traverse points, expand the "minimum number of traverse points" matrix (see Table 1-1) by adding the extra traverse points along one or the other or both legs of the matrix; the final matrix need not be balanced. For example, if a 4x3 "minimum number of points" matrix were expanded to 36 points, the final matrix could be 9x4 or 12x3, and would not necessarily have to be 6x6. After constructing the final matrix, divide the stack cross-section into as many equal rectangular, elemental areas as traverse points, and locate a traverse point at the centroid of each equal area. The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.		Not applicable	The stack is circular, not rectangular.
2.4	Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or		Yes	There are no cyclones or inertial demisters following venturi scrubbers on this system.
	(2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.	Drawing H-2-55019K Rev 2	Yes	This stack does not have a tangential inlet or other duct configuration that tends to induce swirling.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "0° reference." Note the differential pressure (ΔP) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to ± 90° yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each traverse point, calculate the average of the absolute values of α; assign α values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 20°, the overall flow condition in the stack is unacceptable and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses. The alternative procedure described in Section 2.5 may be used to determine the rotation angles in lieu of the procedure described above.		Not applicable	Because there are no cyclones, inertial demisters following venturi scrubbers, tangential inlets, or other duct configuration that tend to induce swirling, there is no need to determine the presence or absence of cyclonic flow.
2.5 Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent stack or duct diameters downstream or less than 1/2 duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation. NOTE: Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plane PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.	Sample Point Positions: Drawing H-2-96794 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Not applicable	The selected site is greater than 2 diameters downstream and 1/2 diameter upstream from a flow disturbance.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.5.1 Apparatus. 2.5.1.1 Directional Probe. Any directional probe, such as United Sensor Type DA Three-Dimensional Directional Probe, capable of measuring both the pitch and yaw angles of gas flows is acceptable. (NOTE: Mention of trade name or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) Assign an identification number to the directional probe, and permanently mark or engrave the number on the body of the probe. The pressure holes or directional probes are susceptible to plugging when used in particulate-laden gas streams. Therefore, a system for cleaning the pressure holes by "backpurging" with pressurized air is required.		Not applicable	See 2.5, above.
2.5.1.2 Differential Pressure Gauges. Inclined manometers, U-tube manometers, or other differential pressure gauges (e.g., magnehelic gauges) that meet the specifications described in Method 2, section 2.2. NOTE: If the differential pressure gauge produces both negative and positive readings, then both negative and positive pressure readings shall be calibrated at a minimum of three points as specified in Method 2, section 2.2.		Not applicable	See 2.5, above.
2.5.2 Traverse Points. Use a minimum of 40 traverse points for circular ducts and 42 points for rectangular ducts for the gas flow angle determinations. Follow section 2.3 and Table 1-1 or 1-2 for the location and layout of the traverse points. If the measurement location is determined to be acceptable according to the criteria in this alternative procedure, use the same traverse point number and locations for sampling and velocity measurements.		Not applicable	See 2.5, above.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.5.3 Measurement Procedure. 2.5.3.1 Prepare the directional probe and differential pressure gauges as recommended by the manufacturer. Capillary tubing or surge tanks may be used to dampen pressure fluctuations. It is recommended, but not required, that a pretest leak check be conducted. To perform a leak check, pressurize or use suction on the impact opening until a reading of at least 7.6 cm (3 in.) H_2O registers on the differential pressure gauge, then plug the impact opening. The pressure of a leak-free system will remain stable for at least 15 seconds.		Not applicable	See 2.5, above.
2.5.3.2 Level and zero the manometers. Since the manometer level and zero may drift because of vibrations and temperature changes, periodically check the level and zero during the traverse.		Not applicable	See 2.5, above.
2.5.3.3 Position the probe at the appropriate locations in the gas stream, and rotate until zero deflection is indicated for the yaw angle pressure gauge. Determine and record the yaw angle. Record the pressure gauge readings for the pitch angle, and determine the pitch angle from the calibration curve. Repeat this procedure for each traverse point. Complete a "back-purge" of the pressure lines and the impact openings prior to measurements of each traverse point. A post-test check as described in section 2.5.3.1 is required. If the criteria for a leak-free system are not met, repair the equipment, and repeat the flow angle measurements.		Not applicable	See 2.5, above.
2.5.4 Calculate the resultant angle at each traverse point, the average resultant angle, and the standard deviation using the following equations. Complete the calculation retaining at least one extra significant figure beyond that of the acquired data. Round the values after the final calculations.		Not applicable	See 2.5, above.
2.5.4.1 Calculate the resultant angle at each traverse point:		Not applicable	See 2.5, above.
2.5.5 The measurement location is acceptable if $R \leq 20°$ and $S_d \leq 10°$.		Not applicable	See 2.5, above.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.5.6 Calibration. Use a flow system as described in Sections 4.1.2.1 and 4.1.2.2 of Method 2. In addition, the flow system shall have the capacity to generate two test-section velocities: one between 365 and 730 m/min (1200 and 2400 ft/min) and one between 730 and 1100 m/min (2400 and 3610ft/min).		Not applicable	See 2.5, above.
2.5.6.1 Cut two entry ports in the test section. The axes through the entry ports shall be perpendicular to each other and intersect in the centroid of the test section. The ports should be elongated slots parallel to the axis of the test section and of sufficient length to allow measurement of pitch angles while maintaining the pitot head position at the test-section centroid. To facilitate alignment of the directional probe during calibration, the test section should be constructed of plexiglass or some other transparent material. All calibration measurement should be made at the same point in the test section, preferably at the centroid of the test-section.		Not applicable	See 2.5, above.
2.5.6.2 To ensure that the gas flow is parallel to the central axis of the test section, follow the procedure in Section 2.4 for cyclonic flow determination to measure the gas flow angles at the centroid of the test section from two test ports located 90° apart. The gas flow angle measured in each port must be ± 2° of 0°. Straightening vanes should be installed, if necessary, to meet this criterion.		Not applicable	See 2.5, above.
2.5.6.3 Pitch Angle Calibration. Performs a calibration traverse according to the manufacturer's recommended protocol in 5° increments for angles from -60° to +60° at one velocity in each of the two ranges specified above. Average the pressure ratio values obtained for each angle in the two flow ranges, and plot a calibration curve with the average values of the pressure ratio (or other suitable measurement factor as recommended by the manufacturer) versus the pitch angle. Draw a smooth line through the data points. Plot also the data values for each traverse point. Determine the differences between the measured data values and the angle from the calibration curve at the same pressure ratio. The difference at each comparison must be within 2° for angles between 0° and 40° and within 3° for angles between 40° and 60°.		Not applicable	See 2.5, above.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.5.6.4 Yaw Angle Calibration. Mark the three-dimensional probe to allow the determination of the yaw position of the probe. This is usually a line extending the length of the probe and aligned with the impact opening. To determine the accuracy of measurements of the yaw angle, only the zero or null position need be calibrated as follows. Place the directional probe in the test section, and rotate the probe until the zero position is found. With a protractor or other angle measuring device, measure the angle indicated by the yaw angle indicator on the three-dimensional probe. This should be within 2° of 0°. Repeat this measurement for any other points along the length of the pitot where yaw angle measurements could be read in order to account for variations in the pitot markings used to indicate pitot head positions.		Not applicable	See 2.5, above.
<u>ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities</u>			
4.2.1.2 Sampling point should be a minimum of five diameters (or 5 times the major dimension for rectangular ducts) downstream from abrupt changes in flow direction or prominent transitions.	Sample Point Positions: Drawing H-2-96794 Rev 2 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above grade, which corresponds to the last major flow disturbance in the stack. The duct diameter is 2.1 m (7 ft). The sample ports are therefore approximately 8.6, 10.6, and 12.6 diameters above the last major disturbance.
4.2.2 Samples should be representative with respect to physical and chemical composition of airstream.	H-2-96794	Yes	Sample points are a minimum of 8 duct diameters downstream from the last contributor and are believed to be representative. Particle size studies are currently under way. This study is under the direction of the Environmental Protection group.
4.3.1 Sensitivity and accuracy of the analytical or counting method will determine the minimum volume of air which must be sampled to obtain the requisite accuracy and precision of results.		Yes	Analytical or counting method is adjusted to provide requisite accuracy and precision.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.2	If possible, the sample should be large enough to permit 1/10 the permissible level to be determined with reliability.	WHC-EP-0141 shows that the PUREX Plant releases are below 1/10 of the permissible level. WHC-IP-0692, Sections 5.2.2.5 and 5.2.2.7	Yes	The frequency of the record sample filter and silver zeolite cartridge exchange follows: • If at all possible, record air samples are left running for a full 168-hour (7-day) week, to ensure a representative sample. • The silver zeolite cartridges are exchanged as follows: - When the cartridges have been in the sample holder for 1 week. - When radiation readings indicate a buildup of greater than 16 mR/hour within the last 8 hours. - When requested by operations management.
5.2.2	Airborne particulate matter should be evaluated and characterized at regular intervals and before any anticipated process change.			Particulate matter is sampled continuously with sample filters removed at the frequency discussed above. The particulate size distribution has not been measured for this stack. Planning is under way for measurements that will generate these data.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
5.2.2.1 Appropriate filtration should be chosen for sampling.		Yes	The Gelman Versapor™ 3000 filter medium is an acrylic copolymer membrane supported by a nonwoven nylon fabric. The manufacturer rates the efficiency of this medium at 91% for 0.3 μm aerosol. The manufacturer recently tested 24 samples from eight rolls in two lots with a 0.3-μm di-octyl phthalate (DOP) aerosol per American Society for Testing and Materials D 2986-71. The measured average efficiency was 95.8%, and the standard deviation was 1.6%. (This corresponds to a lower 90% confidence limit of 93.5% for a single filter.) The manufacturer does not recommend this product for flow rates greater than 52 L/min-cm^2 or for temperatures above 275 °F.
5.2.2.1.7 Filter holders and support should be chosen for proper chemical compatibility, mechanical strength, sealing, and ease of operation in changing filters. Sample air movers should have the capability of delivering the necessary air flow against the resistance of the sampling system. Proper location and choice of flow measurement device and flow rate control is important.	H-2-96780, Sheet 1.	Yes	Stainless steel sample holders have been used in the past. A design has been released to replace these with aluminum sample holders. The sample holders are easily screwed apart and have a sealing ring to ensure that all the gas flows through the filter. The sample flow measurement and control systems ensure that the air mover provides adequate air flow through the sampler. These systems are located downstream of the sample collection media (filters and silver zeolite cartridges) to prevent degradation of the sample.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
5.3	Airborne radioactive gases or volatile materials should be sampled by an appropriate method if present.		Yes	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. Gaseous sampling systems had shown that the levels of ^{3}H and ^{14}C had fallen to levels at or below the analytical detection limit, which were well below environmental release and monitoring limits. Consequently, sampling for these radionuclides is no longer required or performed. The release of other radioactive gases decreased more rapidly than for these radionuclides. Consequently, there is no need for gaseous radionuclide sampling.
A1.	Minimization of the length and bends of sample delivery lines will contribute to representative sampling.			(No response requested.)
A2.	The distance from the last upstream disturbance to the point of sample extraction should be a minimum of five and preferably ten or more duct diameters downstream. Sampling from a vertical run avoids stratification due to gravity settling. Sampling as far downstream as possible avoids most transient variation in airstream quality.	Sample Point Positions: Drawing H-2-96794 Rev. 2 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above the base of the stack, which is the location of the last major disturbance. The duct diameter is 2.1 m (7 ft). The sample ports are therefore approximately 8.6, 10.6, and 12.6 diameters above the last major disturbance.
A3.1	Velocity and flow distribution should be known for the sampling point, and particle and gaseous composition should be representative.	DOE/RL-90-34 Blue Print File-8264-SH-9	YES	The Reynold's number of the stack is approximately 2,000,000, which is solidly in the turbulent regime. Since there are no sources of cyclonic flow, the flow pattern can be described as well developed turbulent.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
A3.2	A multiple number of withdrawal points each representing approximately equal areas based on the duct or stack dimensions is desirable.	H-2-65648	Yes	The rake that has been used for the record sample has sixteen inlet ports, spaced symmetrically about the center line of the stack. The ports are arranged to collect air from the approximate centers of equal-area semi-annuli. (For an annulus, the "center" is half way between the inner and outer radii of an annulus.) The table compares the actual and ideal locations of the inlet ports, and also lists the difference. The positions are measured from the center of the stack. The tolerance on the actual dimensions is 0.3 cm. Old 16-point rake (still used for record sample) Metric (cm) Actual / Ideal — Metric (cm) Difference 18.80 / 18.859 — 0.06 45.72 / 45.529 — 0.19 59.44 / 59.334 — 0.10 70.36 / 70.381 — 0.02 80.01 / 79.886 — 0.12 88.39 / 88.363 — 0.03 96.01 / 96.089 — 0.08 103.12 / 103.235 — 0.11

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
A3.2 A multiple number of withdrawal points each representing approximately equal areas based on the duct or stack dimensions is desirable. (CONTINUED)	H-2-96792 H-2-96793	Yes	The new sample rakes (all the sampling systems except the record sample) are designed to collect samples from the approximate centers of equal-area annuli in the stack. (For an annulus, the "center" is half way between the inner and outer radii of an annulus.) The table below compares the actual and ideal locations of the inlet ports, and also lists the difference in inches. The positions are measured from the center of the stack, in the direction away from the liner penetration. The limits for the locations of the new probes should therefore be: SI (cm) Actual / SI (cm) Ideal / SI (cm) Difference -101.60 / -102.032 / -0.43 -81.28 / -81.269 / 0.01 -50.80 / -52.572 / -1.77 0.00 / 0.000 / 0.00 68.58 / 68.513 / -0.07 91.44 / 92.244 / 0.80
A3.3 The velocity distribution across the duct or stack should be known in order to establish isokinetic flow and representative sample points.	DOE/RL-90-34 Blue Print File-8264-SH-9	Yes	The Reynold's number of the stack is approximately 2,000,000, which is solidly in the turbulent regime. Since there are no sources of cyclonic flow, the flow pattern can be described as well developed turbulent. Sample flow rate is adjusted to maintain isokinesis in sample rake, see Method 114 Comparison, Sections 4.3.6 and 4.3.7.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
A3.4	Sampling probe configuration is recommended by figures in this standard, with minimum radius bends and precisely tapered probe end edges.	H-2-96792 H-2-96793 H-2-65648	Yes	The 291-A-1 samplers use multipoint probes, as described in Figure A5 of ANSI N13.1-1969. The sample inlets are arranged over equal annular areas for all but the record sampler, for which equal semiannular areas are used. Figure A5 calls out a length as approximately five times the diameter and the radius of the bend as more than five times the diameter. For the upper and lower 8-point probes, the diameter is 0.305 in., and the length and radius are both 1.875 in., for a ratio of approximately 6.2. For the middle eight-point probes, the diameter is 0.35 in., and the length and radius are both 2.0 in., for a ratio of approximately 6.6. For the 16-point sample probe, the length and radius are 2.0 in., and the diameters are 0.180 in., 0.194 in., and 0.245 in. The corresponding ratios are 11.1, 10.3, and 8.16.
B1.	Sampling line length should be kept to a minimum length. An estimate of the fraction of particles deposited in sampling lines under various conditions should be made using the experimental data presented in this appendix.	DOE/RL-90-34 p.22 H-2-96794 H-2-65648 Sheet 1	Yes	Using the lowest sample probe location for the record sample minimizes sample line length. Using the methodology of Appendix B, assuming a 2μm particle size and a particle density of 5kg/l, 44% of the particles are estimated to be deposited in the sample line. This estimate does not include resuspension. It is believed that resuspension occurs because there are no indications that the lines are plugging. Furthermore, preliminary results from a line loss study on another stack indicates that more large particles exit long sample lines than enter them. This observation is consistent with the view that deposited particles resuspend after agglomerating on the wall of the sample line.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
B3 Velocities must be kept high enough to avoid appreciable losses by Brownian diffusion.	DOE/RL-90-34 p.22 H-2-65648 Sheet 1	Yes	The sample flow has a Reynold's number of approximately 8,000.
B5 Elbows in sampling lines should be avoided if at all possible. When required, the bend radius of the elbow should be as long as practical, and design flow rates through any line containing an elbow should be kept low. When possible, the sampler installation should allow for probe removal in order to evaluate the losses in the probe entry elbow and to permit cleaning.	H-2-96794	Yes	There are no unnecessary bends. The first bend (in the sample probe) meets the criteria of Appendix A. The second has a radius approximately ten times larger than the largest radius for which the Appendix presents data. The only obstacle to removal of the probe is its extreme height above the ground. This height is mandated by this American National Standards Institute (ANSI) standard.
40 CFR 61, Appendix B, Method 114, Test Methods for Measuring Radionuclide Emissions from Stationary Sources 2.1 Radionuclides as Particulates. The extracted effluent stream is passed through a filter media to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1969 shall be followed in using filter media to collect particulates (incorporated by reference-see § 61.18).	See point-by-point comparison with ANSI N13.1-1969.	Yes	The Gelman Versapor™ 3000 filter medium is an acrylic copolymer membrane supported by a nonwoven nylon fabric. The manufacturer rates the efficiency of this medium at 91% for 0.3-µm aerosol. The manufacturer recently tested 24 samples with a 0.3-µm DOP aerosol per ASTM D 2986-71. The measured average efficiency was 95.8%, and the standard deviation was 1.6%, which supports the rated efficiency (see Section 5.2.2.1).
2.2 Radionuclides as Gases. 2.2.1 The Radionuclide Tritium (H-3). Tritium in the form of water vapor is collected from the extracted effluent sample by sorption, condensation or dissolution techniques. Appropriate collectors may include silica gel, molecular sieves, and ethylene glycol or water bubblers. Tritium in the gaseous form may be measured directly in the sample stream using Method B-1, collected as a gas sample or may be oxidized using a metal catalyst to tritiated water and collected as described above.		Not applicable	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. Gaseous sampling systems have shown that the levels of ^{3}H and ^{14}C have fallen to levels at or below the analytical detection limit, which were well below environmental release and monitoring limits. Consequently, sampling for these radionuclides is no longer required or performed.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
2.2.2 Radionuclides of Iodine. Iodine is collected from an extracted sample by sorption or dissolution techniques. Appropriate collectors may include charcoal, impregnated charcoal, metal zeolite and caustic solutions.		Yes	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. Furthermore, concentrations of radioiodine in any fuel available for processing have decayed to such a low level that there is no longer any requirement to monitor for iodine. Nevertheless, sampling for iodine continues at this time but may be discontinued in the near future. After flowing through the Gelman Versapor™ 3000 filter, the gas sample flows through two silver zeolite cartridges to capture iodine.
2.2.3 Radionuclides of Argon, Krypton and Xenon. Radionuclides of these elements are either measured directly by an in-line or off-line monitor, or are collected from the extracted sample by low temperature sorption techniques. Appropriate sorbers may include charcoal or metal zeolite.		Not applicable	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. The levels of ^{3}H and ^{14}C had fallen to levels at or below the analytical detection limit. The release of other radioactive gases decreased even more rapidly. Consequently, there is no need for gaseous radionuclide sampling.
2.2.4 Radionuclides of Oxygen, Carbon, Nitrogen and Radon. Radionuclides of these elements are measured directly using an in-line or off-line monitor. Radionuclides of carbon in the form of carbon dioxide may be collected by dissolution in caustic solutions.		Not applicable	There is no longer a need for gaseous radionuclide sampling (see Sections 2.2.1 through 2.2.3, above).

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.0 Radionuclide Analysis Methods A series of methods based on "principles of measurement" are described which are applicable to the analysis of radionuclides collected from airborne effluent streams at stationary sources. These methods are applicable only under the conditions stated and within the limitations described. Some methods specify that only a single radionuclide be present in the sample or the chemically separated sample. This condition should be interpreted to mean that no other radionuclides are present in quantities which would interfere with the measurement. Also identified (Table 1) are methods for a selected list of radionuclides. The listed radionuclides are those which are most commonly used and which have the greatest potential for causing dose to members of the public. Use of methods based on principles of measurement other than those described in this section must be approved in advance of use by the Administrator. For radionuclides not listed in Table 1, any of the described methods may be used provided the user can demonstrate that the applicability conditions of the method have been met. The type of method applicable to the analysis of a radionuclide is dependent upon the type of radiation emitted, i.e., alpha, beta or gamma. Therefore, the methods described below are grouped according to principles of measurements for the analysis of alpha, beta and gamma emitting radionuclides.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.1 Methods for Alpha Emitting Radionuclides 3.1.1 Method A-1, Radiochemistry-Alpha Spectrometry. Principle: The element of interest is separated from other elements, and from the sample matrix using radiochemical techniques. The procedure may involve precipitation, ion exchange, or solvent extraction. Carriers (elements chemically similar to the element of interest) may be used. The element is deposited on a planchet in a very thin film by electrodeposition or by coprecipitation on a very small amount of carrier, such as lanthanum fluoride. The deposited element is then counted with an alpha spectrometer. The activity of the nuclide of interest is measured by the number of alpha counts in the appropriate energy region. A correction for chemical yield and counting efficiency is made using a standardized radioactive nuclide (tracer) of the same element. If a radioactive tracer is not available for the element of interest, a predetermined chemical yield factor may be used. Applicability: This method is applicable for determining the activity of any alpha-emitting radionuclide, regardless of what other radionuclides are present in the sample provided the chemical separation step produces a very thin sample and removes all other radionuclides which could interfere in the spectral region of interest. APHA-605(2), ASTM-D-3972(13).	LA-549-112 LA-943-123 LA-542-101 LA-508-051	Yes	Our method involves dissolution (LA-549-112), chemical separation (LA-943-123), electrodeposition (LA-542-101), followed by alpha spectrometry (LA-508-051) (WHC 1992a). It meets all the requirements of the EPA-suggested method. This is used for analyzing ^{241}Am, ^{238}Pu, and $^{239,240}Pu$ in the air filter samples. The activities of these radionuclides are determined by direct comparison with the recoveries of (National Institute of Standards and Technology ([NIST] traceable) ^{243}Am and ^{236}Pu tracers.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.1.2 Method A-2, Radiochemistry-Alpha Counting. Principle: The element of interest is separated from other elements, and from the sample matrix using radiochemistry. The procedure may involve precipitation, ion exchange, or solvent extraction. Carriers (elements chemically similar to the element of interest) may be used. The element is deposited on a planchet in a thin film and counted with a alpha counter. A correction for chemical yield (if necessary) is made. The alpha count rate measures the total activity of all emitting radionuclides of the separated element. Applicability: This method is applicable for the measurement of any alpha-emitting radionuclide, provided no other alpha emitting radionuclide is present in the separated sample. It may also be applicable for determining compliance, when other radionuclides of the separated element are present, provided that the calculated emission rate is assigned to the radionuclide which could be present in the sample that has the highest dose conversion factor. IDO-12096(18).		Not applicable	Because the tracer technique is used in the separation process, this method is not used for air filter analysis.
3.1.3 Method A-3, Direct Alpha Spectrometry. Principle: The sample, collected on a suitable filter, is counted directly on an alpha spectrometer. The sample must be thin enough and collected on the surface of the filter so that any absorption of alpha particle energy in the sample or the filter, which would degrade the spectrum, is minimal. Applicability: This method is applicable to simple mixtures of alpha emitting radionuclides and only when the amount of particulates collected on the filter paper are relatively small and the alpha spectra is adequately resolved. Resolutions should be 50 keV (FWHM) or better, ASTM-D-3084(16).	LO-150-133 LA-508-110. LA-508-051	Not applicable	Our method follows the procedure LO-150-133, then LA-508-110 for total alpha counts, and finally LA-508-051 for alpha spectrometry (WHC 1992a). It partially meets the requirements of the EPA method. This method is usually used for emergency air samples. The sample is counted on the alpha counter of known efficiency to obtain the total alpha counts. In the alpha energy analysis (AEA), the relative peak fractions of different alpha emitters identified in the sample are determined. The peak fractions are then used to correct the total alpha counts and thus determine the activities of individual alpha radionuclides present in the sample.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.1.4	Method A-4, Direct Alpha Counting (Gross alpha determination). Principle: The sample, collected on a suitable filter, is counted with an alpha counter. The sample must be thin enough so that self-absorption is not significant and the filter must be of such a nature that the particles are retained on the surface. Applicability: Gross alpha determination may be used to measure emissions of specific radionuclides only (1) when it is known that the sample contains only a single radionuclide, or the identity and isotopic ratio of the radionuclides in the sample are well known, and (2) measurements using either Method A-1, A-2 or A-5 have shown that this method provides a reasonably accurate measurement of the emission rate. Gross alpha measurements are applicable to unidentified mixtures of radionuclides only for the purposes and under the conditions described in section 3.7. APHA-601(3), ASTM-D-1943(10).	LA-508-110 LA-508-114	Yes	Our method follows the procedure LA-508-110 or LA-508-114 (WHC 1992a). It meets all of the requirements stated in the EPA-suggested method.
3.1.5	Method A-5, Chemical Determination of Uranium. Uranium: Uranium may be measured chemically by either colorimetry or fluorometry. In both procedures, the sample is dissolved, the uranium is oxidized to the hexavalent form and extracted into a suitable solvent. Impurities are removed from the solvent layer. For colorimetry, dibenzoylmethane is added, and the uranium is measured by the absorbance in a colorimeter. For fluorometry, a portion of the solution is fused with a sodium fluoride-lithium fluoride flux and the uranium is determined by the ultraviolet activated fluorescence of the fused disk in a fluorometer. Applicability: This method is applicable to the measurements of emission rates of uranium when the isotopic ratio of the uranium radionuclides is well known. ASTM-E-318(15), ASTM-D-2907(14).	LA-925-107	Exceeds performance of EPA method	Total uranium is determined by procedure LA-925-107 (WHC 1992a). The laser-induced kinetic phosphorescence analyzer is an improvement over the old fluorometric method for uranium determination. It is highly sensitive (lower detection level of 50 ppt is quite possible) because the laser frequency is used specifically for excitation of uranium atoms. It is faster and produces quality numbers. Quality can also be monitored during analysis. It exceeds the requirements mentioned in the EPA method.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.1.6 Method A-6, Radon-222-Continuous Gas Monitor. Principle: Radon-222 is measured directly in a continuously extracted sample stream by passing the air stream through a calibrated scintillation cell. Prior to the scintillation cell, the air stream is treated to remove particulates and excess moisture. The alpha particles from radon-222 and its decay products strike a zinc sulfide coating on the inside of the scintillation cell producing light pulses. The light pulses are detected by a photomultiplier tube which generates electrical pulses. These pulses are processed by the system electronics and the read out is in pCi/l of radon-222. Applicability: This method is applicable to the measurement of radon-222 in effluent streams which do not contain significant quantities of radon-220. Users of this method should calibrate the monitor in a radon calibration chamber at least twice per year. The background of the monitor should also be checked periodically by operating the instrument in a low radon environment. EPA 520/1-89-009(24).		Not applicable	
3.1.7 Method A-7, Radon-222-Alpha Track Detectors Principle: Radon-222 is measured directly in the effluent stream using alpha track detectors (ATD). The alpha particles emitted by radon-222 and its decay products strike a small plastic strip and produce submicron damage tracks. The plastic strip is placed in a caustic solution that accentuates the damage tracks which are counted using a microscope or automatic counting system. The number of tracks per unit area is corrected to the radon concentration in air using a conversion factor derived from data generated in a radon calibration facility. Applicability: Prior approval from EPA is required for use of this method. This method is only applicable to effluent streams which do not contain significant quantities of radon-220, unless special detectors are used to discriminate against radon-220. This method may be used only when ATDs have been demonstrated to produce data comparable to data obtained with Method A-6. Such data should be submitted to EPA when requesting approval for the use of this method. EPA 520/1-89-009(24).		Not applicable	

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.2 Methods for Gaseous Beta Emitting Radionuclides. 3.2.1 Method B-1, Direct Counting in Flow-Through Ionization Chambers. Principle: An ionization chamber containing a specific volume of gas which flows at a given flow rate through the chamber is used. The sample (effluent stream sample) acts as the counting gas for the chamber. The activity of the radionuclide is determined from the current measured in the ionization chamber. Applicability: This method is applicable for measuring the activity of a gaseous beta emitting radionuclide in an effluent stream that is suitable as a counting gas, when no other beta-emitting nuclides are present. DOE/EP-0096(1 7), NCRP-58(23).		Not applicable	Noble gases are not monitored. Rather, the total available inventory is assumed to be released during fuel dissolution. (The PUREX plant ventilation system has no barriers to the escape of noble gases.)
3.2.2 Method B-2, Direct Counting With In-line or Off-line Beta Detectors. Principle: The beta detector is placed directly in the effluent stream (in-line) or an extracted sample of the effluent stream is passed through a chamber containing a beta detector (off-line). The activities of the radionuclides present in the effluent stream are determined from the beta count rate, and a knowledge of the radionuclides present and the relationship of the gross beta count rate and the specific radionuclide concentration. Applicability: This method is applicable only to radionuclides with maximum beta particle energies greater then 0.2 MeV. This method may be used to measure emissions of specific radionuclides only when it is known that the sample contains only a single radionuclide or the identity and isotopic ratio of the radionuclides in the effluent stream are well known. Specific radionuclide analysis of periodic grab samples may be used to identify the types and quantities of radionuclides present and to establish the relationship between specific radionuclide analyses and gross beta count rates. This method is applicable to unidentified mixtures of gaseous radionuclides only for the purposes and under the conditions described in section 3.7.		Not applicable	

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.3 Methods for Non-Gaseous Beta Emitting Radionuclides. 3.3.1 Method B-3, Radiochemistry-Beta Counting. Principle: The element of interest is separated from other elements, and from the sample matrix by radiochemistry. This may involve precipitation, distillation, ion exchange, or solvent extraction. Carriers (elements chemically similar to the element of interest) may be used. The element is deposited on a planchet, and counted with a beta counter. Corrections for chemical yield and decay (if necessary) are made. The beta count rate determines the total activity of all radionuclides of the separated element. This method may also involve the radiochemical separation and counting of a daughter element, after a suitable period of ingrowth, in which case it is specific for the parent nuclide. Applicability: This method is applicable for measuring the activity of any beta-emitting radionuclide, with a maximum energy greater than 0.2 MeV, provided no other radionuclide is present in the separated sample. APHA-608(5).	LA-549-112 LA-220-103 LA-508-111	Yes	Our method for determining ^{89}Sr, $^{90}Sr/^{90}Y$ in air filter samples is carried out using procedures LA-549-112 (dissolution) and LA-220-103 (for chemical separation), followed by procedure LA-508-111 (total beta counting) (WHC 1992a). The laboratory method certainly meets the requirements stated above.
3.3.2 Method B-4, Direct Beta Counting (Gross beta determination). Principle: The sample, collected on a suitable filter, is counted with a beta counter. The sample must be thin enough so that self-absorption corrections can be made. Applicability: Gross beta measurements are applicable only to radionuclides with maximum beta particle energies greater than 0.2 MeV. Gross beta measurements may be used to measure emissions of specific radionuclides only (1) when it is known that the sample contains only a single radionuclide, and (2) measurements made using Method B-3 show reasonable agreement with the gross beta measurement. Gross beta measurements are applicable to mixtures of radionuclides only for the purposes and under the conditions described in section 3.7. APHA-602(4), ASTM-D-1890(11).	LA-508-110 LA-508-114	Yes	For gross beta determination, procedure LA-508-110 or LA-508-114 is followed (WHC 1992a). It satisfies the method requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.3.3 Method B-5, Liquid Scintillation Spectrometry. Principle: An aliquot of a collected sample or the result of some other chemical separation or processing technique is added to a liquid scintillation "cocktail" which is viewed by photomultiplier tubes in a liquid scintillation spectrometer. The spectrometer is adjusted to establish a channel or "window" for the pulse energy appropriate to the nuclide of interest. The activity of the nuclide of interest is measured by the counting rate in the appropriate energy channel. Corrections are made for chemical yield where separations are made. Applicability: This method is applicable to any beta-emitting nuclide when no other radionuclide is present in the sample or the separated sample provided that it can be incorporated in the scintillation cocktail. This method is also applicable for samples which contain more than one radionuclide but only when the energies of the beta particles are sufficiently separated so that they can be resolved by the spectrometer. This method is most applicable to the measurement of low-energy beta emitters such as tritium and carbon-14. APHA.609(6), EMLLV-539-17(19).	LA-348-101 LA-218-112 LA-508-121 LA-548-111 LA-549-112 LA-613-111	Yes	It is used for determining ^{147}Pm in air filter samples (LA-549-112 for dissolution, LA-613-111 for chemical separation, LA-548-111 for incorporating into scintillation cocktail, and LA-508-121 for liquid scintillation counting). This is also used for determination of ^{14}C (LA-348-101, LA-548-111, and LA-508-121, sequentially) and ^{3}H (LA-218-112, LA-548-111, and LA-508-121, sequentially) in gas samples (WHC 1992a). This method satisfies all of the requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.4 Gamma Emitting Radionuclides 3.4.1 Method G-1. High Resolution Gamma Spectrometry. Principle: The sample is counted with a high resolution gamma detector, usually either a Ge(Li) or a high purity Ge detector, connected to a multichannel analyzer or computer. The gamma emitting radionuclides in the sample are measured from the gamma count rates in the energy regions characteristic of the individual radionuclide. Corrections are made for counts contributed by other radionuclides to the spectral regions of the radionuclides of interest. Radiochemical separations may be made prior to counting but are usually not necessary. Applicability: This method is applicable to the measurement of any gamma emitting radionuclide with gamma energies greater than 20 keV. It can be applied to complex mixtures of radionuclides. The samples counted may be in the form of particulate filters, absorbers, liquids or gases. The method may also be applied to the analysis of gaseous gamma emitting radionuclides directly in an effluent stream by passing the stream through a chamber or cell containing the detector. ASTM-3649(9), IDO-12096(18).	LA-508-052	Yes	Our method uses gamma ray spectroscopy with high-resolution germanium detectors and follows procedure LA-508-052 (WHC 1992a). It meets all the requirements explained in the EPA method.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.4.2 Method G-2, Low Resolution Gamma Spectrometry. Principle: The sample is counted with a low resolution gamma detector, a thallium activated sodium iodide crystal. The detector is coupled to a photomultiplier tube and connected to a multichannel analyzer. The gamma emitting radionuclides in the sample are measured from the gamma count rates in the energy regions characteristic of the individual radionuclides. Corrections are made for counts contributed by other radionuclides to the spectral regions of the radionuclides of interest. Radiochemical separation may be used prior to counting to obtain less complex gamma spectra if needed. Applicability: This method is applicable to the measurement of gamma emitting radionuclides with energies greater than 100 keV. It can be applied only to relatively simple mixtures of gamma emitting radionuclides. The samples counted may be in the form of particulate filters, absorbers, liquids or gas. The method can be applied to the analysis of gaseous radionuclides directly in an effluent stream by passing the gas stream through a chamber or cell containing the detector. ASTM-D-2459(12), EMSL-LV-0539-17(19).		Not applicable	
3.4.3 Method G-3, Single Channel Gamma Spectrometry. Principle: The sample is counted with a thallium activated sodium iodide crystal. The detector is coupled to a photomultiplier tube connected to a single channel analyzer. The activity of a gamma emitting radionuclide is determined from the gamma counts in the energy range for which the counter is set. Applicability: This method is applicable to the measurement of a single gamma emitting radionuclide. It is not applicable to mixtures of radionuclides. The samples counted may be in the form of particulate filters, absorbers, liquids or gas. The method can be applied to the analysis of gaseous radionuclides directly in an effluent stream by passing the gas stream through a chamber or cell containing the detector.		Not applicable	

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.4.4 Method G-4, Gross Gamma Counting. Principle: The sample is counted with a gamma detector usually a thallium activated sodium iodine crystal. The detector is coupled to a photomultiplier tube and gamma rays above a specific threshold energy level are counted. Applicability: Gross gamma measurements may be used to measure emissions of specific radionuclides only when it is known that the sample contains a single radionuclide or the identity and isotopic ratio of the radionuclides in the effluent stream are well known. When gross gamma measurements are used to determine emissions of specific radionuclides periodic measurements using Methods G-1 or G-2 should be made to demonstrate that the gross gamma measurements provide reliable emission data. This method may be applied to analysis of gaseous radionuclides directly in an effluent stream by placing the detector directly in or adjacent to the effluent stream or passing an extracted sample of the effluent stream through a chamber or cell containing the detector.		Not applicable	

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.5	Counting Methods. All of the methods with the exception of Method A-5 involve counting the radiation emitted by the radionuclide. Counting methods applicable to the measurement of alpha, beta and gamma radiations are listed below. The equipment needed and the counting principles involved are described in detail in ASTM-3648(8).		Yes	Alpha proportional counters (home-built chambers with EG&G ORTEC electronics), window-type gas flow proportional counters (some having automatic sample changer), surface-barrier solid-state detectors connected to a multichannel analyzer (MCA) (Series 85, Jupiter™ system manufactured by Canberra Industries, Inc.) are used for air filter analysis in 222-S Laboratory. Laboratory equipment meets the EPA specifications.
3.5.1	Alpha Counting: ▪Gas Flow Proportional Counters. The alpha particles cause ionization in the counting gas and the resulting electrical pulses are counted. These counters may be windowless or have very thin windows. ▪Scintillation Counters. The alpha particles transfer energy to a scintillator resulting in a production of light photons which strike a photomultiplier tube converting the light photons to electrical pulses which are counted. The counters may involve the use of solid scintillation materials such as zinc sulfide or liquid scintillation solutions. ▪Solid-State Counters. Semiconductor materials, such as silicon surface-barrier p-n junctions, act as solid ionization chambers. The alpha particles interact which the detector producing electron hole pairs. The charged pair is collected by an applied electrical field and the resulting electrical pulses are counted. ▪Alpha Spectrometers. Semiconductor detectors used in conjunction with multichannel analyzers for energy discrimination.			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.5.2 Beta Counting: ▪Ionization Chambers. These chambers contain the beta-emitting nuclide in gaseous form. The ionization current produced is measured. ▪Geiger-Muller (GM) Counters or Gas Flow Proportional Counters. The beta particles cause ionization in the counting gas and the resulting electrical pulses are counted. Proportional gas flow counters which are heavily shielded by lead or other metal, and provided with an anti-coincidence shield to reject cosmic rays, are called low background beta counters. ▪Scintillation Counters. The beta particles transfer energy to a scintillator resulting in a production of light photons, which strike a photomultiplier tube converting the light photon to electrical pulses which are counted. This may involve the use of anthracene crystals, plastic scintillator, or liquid scintillation solutions with organic phosphors. ▪Liquid Scintillation Spectrometers. Liquid scintillation counters which use two photomultiplier tubes in coincidence to reduce background counts. This counter may also electronically discriminate among pulses of a given range of energy.		Yes	Window-type gas flow proportional counter (some having an automatic sample changer) liquid scintillation spectrometers manufactured by Beckman Instruments, Inc., are used for analysis. Our counting equipment meets the requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.5.3 Gamma Counting: ▪Low-Resolution Gamma Spectrometers. The gamma rays interact with thallium-activated sodium iodide or cesium iodide crystal resulting in the release of light photons which strike a photomultiplier tube converting the light pulses to electrical pulses proportional to the energy of the gamma ray. Multi-channel analyzers are used to separate and store the pulses according to the energy absorbed in the crystal. ▪High-Resolution gamma Spectrometers. Gamma rays interact with a lithium-drifted (Ge(Li)) or high-purity germanium (HPGe) semiconductor detectors resulting in a production of electron-hole pairs. The charged pair is collected by an applied electrical field. A very stable low noise preamplifier amplifies the pulses of electrical charge resulting from the gamma photon interactions. Multichannel analyzers or computers are used to separate and store the pulses according to the energy absorbed in the crystal. ▪Single Channel Analyzers. Thallium activated sodium iodide crystals used with a single window analyzer. Pulses from the photomultiplier tubes are separated in a single predetermined energy range.		Yes	High-resolution gamma detectors (high-purity Ge detectors for both low and high energies) from EG&G ORTEC and Princeton Gamma Tech, well-type pure Ge detectors connected to MCA (Canberra's Jupiter system) are available and used for air filter analysis. Our equipment exceeds the EPA requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.5.4 Calibration of Counters. Counters are calibrated for specific radionuclide measurements using a standard of the radionuclide under either identical or very similar conditions as the sample to be counted. For gamma spectrometers a series of standards covering the energy range of interest may be used to construct a calibration curve relating gamma energy to counting efficiency. In those cases where a standard is not available for a radionuclide, counters may be calibrated using a standard with energy characteristics as similar as possible to the radionuclide to be measured. For gross alpha and beta measurements of the unidentified mixtures of radionuclides, alpha counters are calibrated with a natural uranium standard and beta counters with a cesium-137 standard. The standard must contain the same weight and distribution of solids as the samples, and be mounted in an identical manner. If the samples contain variable amounts of solids, calibration curves relating weight of solids present to counting efficiency are prepared. Standards other than those prescribed may be used provided it can be shown that such standards are more applicable to the radionuclide mixture measured. (Continued below)		Yes	A mixed gamma standard (NIST traceable) emitting various gamma-rays ranging from 59 to 1850 keV is used, using vendor-supplied calibration software, for constructing efficiency versus energy calibration curves for different geometrical configurations used in gamma analysis. The calibration procedure for gamma ray spectrometer is documented in LQ-508-003 (WHC 1992a). Our calibration procedure meets the EPA criteria for gamma ray spectroscopic analysis. For calibration of beta detectors for ^{90}Sr/^{90}Y analysis, procedure LQ-508-002 is used in conjunction with LQ-508-005. It meets the requirements of the EPA-suggested method. A method standard also is used to check the performance and calibration of the detector. For calibration of alpha/beta proportional counters, the procedure LQ-508-002 is carried out. It partially deviates from the EPA requirements. For gross alpha and gross beta measurements, our instruments are calibrated with ^{241}Am and ^{60}Co standards, respectively. The reasons for choosing the ^{241}Am standard for alpha calibration are as follows: • It is commonly found in the main stack air samples. • Alpha counting efficiency usually is the same for other alpha emitters that also are found in the air stack samples • The ^{241}Am standard also can be checked independently by gamma analysis.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.5.4. (Continued)		Yes	The reason for using the ^{60}Co standard for beta calibration is the lower counting efficiency with ^{60}Co (beta max = 317 keV) compared to those with ^{137}Cs (beta max = 511 keV) and ^{90}Sr (beta max = 546 keV). Consequently, it will generate conservative numbers in our analysis. The calibration curves relating weight of solids present to counting efficiencies are not done in alpha/beta analysis, but currently are being evaluated.
3.6 Radiochemical Methods for Selected Radionuclides. Methods for a selected list of radionuclides are listed in Table 1. The radionuclides listed are those which are most commonly used and which have the greatest potential for causing doses to members of the public. For radionuclides not listed in Table 1, methods based on any of the applicable "principles of measurement" described in section 3.1 through 3.4 may be used.		Yes	The air samples from the main stacks are well characterized. Some of the radionuclides identified (^{241}Am, ^{238}Pu, $^{239,240}Pu$, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{147}Pm, ^{14}C, ^{3}H, and ^{131}I) are listed in Table 1 of Method 114 (EPA 1991) and are analyzed according to the approved methods given in the table. Other radionuclides (^{95}Nb, ^{95}Zr, ^{129}I, ^{106}Rh/^{106}Ru, ^{113}Sn, ^{125}Sb, and ^{103}Ru) not listed in the table are analyzed by the methods outlined in Method 114, depending on the type of emitted radiations. It is important to note here that the radionuclides ^{95}Zr, ^{95}Nb, and ^{103}Ru have nearly decayed to nondetectable levels because no product is being produced.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
3.7 Applicability of Gross Alpha and Beta Measurements to Unidentified Mixtures of Radionuclides. Gross alpha and beta measurements may be used as a screening measurement as a part of an emission measurement program to identify the need to do specific radionuclide analyses or to confirm or verify that unexpected radionuclides are not being released in significant quantities. Gross alpha (Method A-4) or gross beta (Methods B-2 or B-4) measurements may also be used for the purpose of comparing the measured concentrations in the effluent stream with the limiting "Concentration Levels for Environmental Compliance" in Table 2 of Appendix E. For unidentified mixtures, the measured concentration value shall be compared with the lowest environmental concentration limit for any radionuclide which is not known to be absent from the effluent stream.		Not applicable	This is not applicable because the air effluents from the Hanford Site main stacks are well characterized. However, gross alpha and beta analyses for weekly and daily air samples are routinely performed in the 222-S Laboratory before starting specific radionuclide analyses. Following this practice, the facility can verify a significant release of a radionuclide into the air so corrective actions to minimize radionuclide emission into the environment can be taken promptly by facility personnel. The gross alpha and beta results from analysis are compared to those listed in the appendix of DOE Order 5400.5 (DOE 1990) for compliance.
4.0 Quality Assurance Methods Each facility required to measure their radionuclide emissions shall conduct a quality assurance program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative, and are of known precision and accuracy and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions and reports. This quality assurance program shall include the following program elements: 4.1 The organizational structure functional responsibilities, levels of authority and lines of communications for all activities related to the emissions measurement program shall be identified and documented.	WHC-EP-0536	Yes	See Section 6.2 of WHC-EP-0536 for the organizational structure

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.	WHC-CM-4-12, Section 1.14, REV 0, ALARM RESPONSE AND MANAGEMENT	Yes	WHC-CM-4-12 (WHC 1992c), Section 1.14, REV 0, ALARM RESPONSE AND MANAGEMENT. Provides guidance and sets requirements for managing the responses to alarms which are the responsibility of Occupational Health and Safety (OHS). This practice is applicable to all members of the Occupational Health and Safety organization. Area Health and Safety managers shall ensure that all members of their organizations are aware of and adhere to this practice.
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CM-4-12, Section 2.1, REV 0, RADIOLOGICAL PROBLEM REPORTING PROGRAM	Yes	WHC-CM-4-12, Section 2.1, REV 0, RADIOLOGICAL PROBLEM REPORTING PROGRAM. The purpose of the Radiological Problem Report (RPR) program is to provide a documented record of observed radiological problems, a mechanism for reporting these problems to management for action, a capability to track and monitor the progress of the planned corrective actions, and a database for assessing trends in radiological program performance and needed actions.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CM-4-12, Section 12.1, REV 1 EMERGENCY RESPONSE	Yes	WHC-CM-4-12, Section 12.1, REV 1 EMERGENCY RESPONSE. An EMERGENCY is a sudden, unexpected event requiring immediate response to mitigate impacts to people, property, or the environment. When radioactive material is involved, Health Physics (HP) plays a major role in evaluating, controlling, and recovering from the event. To be able to perform this function HP personnel receive training to respond to a variety of emergency situations. The HP procedures are written to provide guidelines to respond to emergencies. Together, the training and written procedure detail the HP Emergency Response Program. Emergency Response. The HP personnel are, in many situations, the first to respond to a radiological emergency. The ability to assess and evaluate the situation and take immediate steps to minimize the effects of the event is crucial for controlling the emergency. The HP personnel must use their training and experience to make good decisions during the initial response to an emergency.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CM-4-12, Section 12.1, REV 1 EMERGENCY RESPONSE	Yes	An emergency response may be initiated by personnel observing the event, alarms, the Patrol Operation Center, or the Emergency Control Center(s) once they are staffed. For a planned response, HP personnel shall be in teams of at least two. Out of necessity (e.g., backshift response), one member could be an Operations person or other emergency service person such as fire or patrol. A rapid response is required; however, no undue risks should be taken nor should employee personnel safety be compromised. The type of emergency determines the level of planning for HP response. For example, a continuous air monitor (CAM) alarm or a small radioactive spill requires little planning for the initial response. However, when an emergency causes a facility evacuation, preplanning (e.g., stay time, entry route) and approval of the Building/Facility Emergency Director is necessary for a re-entry. Although HP personnel respond to an emergency using basic guidelines, an area/facility may have specific procedures that have priority over these guidelines.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-IP-0692 , Section 12.1.2.3, REV 2, EFFLUENT EXHAUST CAM ALARM RESPONSE WHC-IP-0692 , Section 12.1.2.4, REV 0, PUREX MAIN STACK (291-A-1) ALARM RESPONSE	Yes	WHC-IP-0692 (WHC 1991b), Section 12.1.2.3, REV 2, EFFLUENT EXHAUST CAM ALARM RESPONSE. This procedure establishes the standard method of handling samples from, and response to alarms at, Effluent Exhaust CAM systems. WHC-IP-0692, Section 12.1.2.4, REV 0, PUREX MAIN STACK (291-A-1) ALARM RESPONSE. This procedure establishes the method of responding to alarms occurring on the Moving Filter Radioactive Aerosol Monitor (MFRAM), on the Continuous Particulate Release Monitor (CPRM), to alarms on the CPRM or MFRAM iodine monitors, or to high-activity levels detected on the Effluent Release Record Sample.
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-IP-0692 , Section 12.1.6, REV 2, STACK EFFLUENT RELEASE RESPONSE WHC-IP-0692, Section 12.2.1, REV 2, EMERGENCY RESPONSE AIR SAMPLING WHC-IP-0692, Section 12.2.3, REV 0, HEALTH PHYSICS EMERGENCY RESPONSE TEAM	Yes	WHC-IP-0692, Section 12.1.6, REV 2, STACK EFFLUENT RELEASE RESPONSE. This procedure establishes guidelines for responding to a potential or actual release of radioactive material through exhaust stacks. WHC-IP-0692, Section 12.2.1, REV 2, EMERGENCY RESPONSE AIR SAMPLING. This procedure establishes the instruction and guidelines for air sampling in an emergency situation. WHC-IP-0692, Section 12.2.3, REV 0, HEALTH PHYSICS EMERGENCY RESPONSE TEAM. This procedure provides the organizational structure of, the instructions for, and the responsibilities of the HP Emergency Response Team and the Health Physics Technician Field Survey Teams.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.2	Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-IP-0629, Section 12.2.4, REV 2, EMERGENCY RADIOACTIVE PLUME TRACKING WHC-IP-0629, Section 12.2.6, REV 0, GENERAL GUIDELINES FOR EMERGENCY RESPONSE WHC-IP-0263-202A, Westinghouse Hanford Company Emergency Plan for PUREX Facility	Yes	WHC-IP-0692, Section 12.2.4, REV 2, EMERGENCY RADIOACTIVE PLUME TRACKING. This procedure establishes the instructions to track a plume created from a radioactive material release to the environment. WHC-IP-0692, Section 12.2.6, REV 0, GENERAL GUIDELINES FOR EMERGENCY RESPONSE. This procedure provides general guidelines to handle emergency situations. WHC-IP-0263-202A (WHC 1991d), Westinghouse Hanford Company Emergency Plan for PUREX Facility. This document provides instructions for many types of emergencies, including excessive releases of radioactivity via the stacks.
4.2	Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CM-5-9, Section 2.3, REV 1, PUREX/UO_3 Plant Occurrence Categorization, Notification, and Reporting	Yes	WHC-CM-5-9 (WHC 1992c), REV 1, Section 2.3, "PUREX/UO_3 Plant Occurrence Categorization, Notification, and Reporting." This procedure provides instructions for notification and reporting of specific events including environmental releases and related events.
4.3	The sample collection and analysis procedures used in measuring the emissions shall be described including where applicable:			

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.1	Identification of sampling sites and number of sampling points, including the rationale for site selections.		Yes	The 291-A-1 stack is 2.1 m (7 ft) in diameter. The record sampling site is a vertical section of the stack, at a height of 18 m (60 ft) above grade. There are a total of three sampling sites and six sampling probes. The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above grade, which is the location of the last major flow disturbance in the stack. The sample ports are, therefore, approximately 8.6, 10.6, and 12.6 diameters downstream of the last major disturbance. The stack is 61 m (200 ft), or 28.6 diameters, tall. The sample ports are, therefore, approximately 20, 18, and 16 diameters upstream of the next major flow disturbance. The sites were chosen to provide representative sampling of the effluent and to comply with ANSI N13.1-1969 (ANSI 1969). The lowest sample port was chosen as the location of the record sample probe to minimize the length of sample line in accordance with ANSI N13.1-1969. These sample points also meet the criteria of 40 CFR 60, Appendix A, Method 1 (EPA 1991).

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.2 A description of sampling probes... (Continued below).		Yes	The sampling probes are "rakes," that is, multiport probes. The rakes are paired (i.e., there are two rakes at each sample location). With the exception of the particulate record sample, each rake has six inlet ports consisting of 3/8 in. outer diameter by 0.035 in. wall 316 stainless steel tubing. At the inlet, each port is tapered to a knife edge with a 15-degree angle. At the 74-ft level, the inlet ports have a 2-in. vertical section followed by a 2-in. radius bend leading into the rake. (The backup record sample is collected from a rake at the 74-ft level.) At the 60-ft and 88-ft levels, the inlet ports have a 1-7/8-in. vertical section followed by a 1-7/8-in. radius bend.
4.3.2 A description of sampling probes... (Continued)			The six-point sample rakes collect samples from the approximate centers of equal-area annuli in the stack, alternating between the near and far sides of the annuli. (For an annulus, the "center" is halfway between the inner and outer radii of an annulus.) The table below compares the actual and ideal locations of the inlet ports, and also lists the difference in inches. The positions are measured from the center of the stack in the direction away from the liner penetration. The tolerance on the actual dimensions is 0.3 cm. The limits for the locations of the new probes should therefore be: SI (cm) Actual / SI (cm) Ideal / SI (cm) Difference -101.60 / -102.032 / -0.43 -81.28 / -81.269 / 0.01 -50.80 / -52.572 / -1.77 0.00 / 0.000 / 0.00 68.58 / 68.513 / -0.07 91.44 / 92.244 / 0.80

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.2 A description of sampling probes... (Continued)			The rake that currently collects the particulate record sample has 16 inlets, consisting of 304 stainless steel tubing. At the inlet, each port is tapered to a knife edge with a 15-degree angle. The inlet ports have a 2-in. vertical section followed by a 2-in. radius bend leading into the rake at a 45-degree angle. The outer two ports are made of 3/8 in. outer diameter, 0.065-in. wall tube. The next six ports are made of 1/4 in. outer diameter, 0.028-in. wall tube. The inner eight ports are made of 1/4 in. outer diameter, 0.035-in. wall tube. The inlet ports are arranged symmetrically and approximately centered over equal-area semi-annuli. The table compares the actual and ideal locations of the inlet ports, and also lists the difference. The positions are measured from the center of the stack. The tolerance on the actual dimensions is 0.3 cm. Old 16-point rake (still used for record sample) Metric (cm) Actual / Ideal / Metric (cm) Difference 18.80 / 18.859 / 0.06 45.72 / 45.529 / 0.19 59.44 / 59.334 / 0.10 70.36 / 70.381 / 0.02 80.01 / 79.886 / 0.12 88.39 / 88.363 / 0.03 96.01 / 96.089 / 0.08 103.12 / 103.235 / 0.11
4.3.2 (Continued) A description of representativeness of the samples.		Yes	The use of an isokinetic 16-point probe located more than eight duct diameters downstream of the last major flow disturbance ensures representative sampling.
4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures and frequency of calibration.		Yes	Not applicable--emissions are not monitored continuously for compliance demonstration.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures and frequency of calibration. (Continued Below)		Yes	The sample is continuously removed from the effluent stream via the rake described in Section 4.3.2. The sample then flows through the sample line and the particulates are collected on a sample filter. The sample filters are replaced weekly, and sometimes more often. The filtered gas then flows through two silver zeolite cartridges to capture iodine and other volatile elements. Section 4.3.6 describes the calibration of the sample flow rate measurement equipment.
4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures and frequency of calibration. (Continued)		Yes	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. Gaseous sampling systems had shown that the levels of ^{3}H and ^{14}C had fallen to levels at or below the analytical detection limit, which were well below environmental release and monitoring limits. Consequently, sampling for these radionuclides is no longer required or performed. The release of other radioactive gases decreased more rapidly than for these radionuclides. Consequently, there is no need for gaseous radionuclide sampling.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued Below)	LA-508-110 LA-508-114 LO-150-115 LQ-508-002	Yes	Total alpha/total beta activity is determined by procedure LA-508-110 or LA-508-114 on weekly samples, and occasionally on daily air samples, per collection point. The calibration procedure is documented in LQ-508-002. It is done only when deemed necessary by a responsible scientist. The counting system is recalibrated only in case of (1) major repairs or adjustments to the power supply or detector or (2) calibration shift as indicated by the instrument control standards. The performance of the counting systems is checked by running the instrument control standards (^{147}Pm for low-energy beta, ^{60}Co for mid-energy beta, ^{137}Cs for high-energy beta, and ^{241}Am for alpha activity) separately. When a batch of air filter samples is run, all the performance standards and the background (for counting frequency refer to LO-150-115) also are run with it. To verify that the counting system is working properly, the standard values from analysis should fall within the administrative limits set according to appropriate quality assurance program plans (QAPP).

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)	LA-508-051 LA-542-101 LA-943-123 LO-150-115	Yes	Our laboratory method for analysis of alpha emitters (^{241}Am, ^{238}Pu, and ^{239,240}Pu) involves various steps (LA-549-112 for dissolution, LA-943-123 for chemical separation, LA-542-101 for electrodeposition, and LA-508-051 for final alpha spectrometry). The analysis of alpha emitters is done on a quarterly composite of weekly/daily air filter samples. The energy resolution and calibration of the AEA system over the energy range of 4 to 6 MeV are checked once a month by the preventive maintenance (PM) procedure 2S18006. Efficiency calibration of the AEA is not needed in our analysis method because direct comparison of the sample with recoveries of the tracers (^{243}Am and ^{236}Pu) is made to determine the activities of the radionuclides present in the sample. To carry out the sample analysis, AEA system performance is checked once every 24 hours for alpha energy shift with a certified mixed alpha source standard. Each alpha energy peak identified in the standard must fall within administratively assigned certain channels (+10) on the MCA. For counting frequency of performance check standards, procedure LO-150-115 is referred to. The recovery of the radionuclides and the calibration of the system are checked on a batch basis by running a method standard under the identical conditions as the sample.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)	LA-220-103 LA-508-111 LA-549-112 LQ-508-002 LQ-508-005	Yes	The lab method for determining beta activity (^{89}Sr, $^{90}Sr/^{90}Y$) consists of a dissolution step (LA-549-112), chemical separation (LA-220-103), and total beta counting (LA-508-111). Analysis is done on a quarterly composite of weekly/daily air filter samples per collection point. The calibration procedure LQ-508-002 (for window-type gas flow proportional counter) is used in conjunction with LQ-508-005 (for mother/daughter case, i.e., $^{90}Sr/^{90}Y$ in growth calibration). It is performed only when the responsible scientist finds it necessary. The reasons are the same as stated for total alpha/total beta. The performance of the counting system is checked once per shift by running instrument control standards (^{60}Co, ^{137}Cs, and ^{147}Pm for beta activity). The complete procedure for the $^{90}Sr/^{90}Y$ analysis in the sample is carried out with a method standard (several filter papers spiked with ^{90}Sr, ^{147}Pm, ^{60}Co, ^{241}Am, ^{239}Pu, and U provided by the 222-SA Standard Laboratory) on a batch basis. This checks the overall performance of our method. The chemical yield is determined by using appropriate carrier.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)	LA-218-112 LA-348-101 LA-508-111 LA-508-121 LA-549-112 LA-613-111 LO-150-115	Yes	Determination of beta activity (^{147}Pm, ^{14}C, and ^{3}H) involves processing (LA-549-112 and LA-613-111 for ^{147}Pm, LA-348-101 for ^{14}C, and LA-218-112 for ^{3}H), mounting in scintillation cocktail (LA-508-111), and finally, liquid scintillation counting (LA-508-121). The ^{147}Pm analysis is done on quarterly composites of weekly/daily air filter samples. The ^{14}C and ^{3}H analyses are done on biweekly gas samples. For calibration, the quality assurance (QA) section of procedure LA-508-121 is referenced. The calibration of the instrument is checked by the manufacturer's supplied sources (^{14}C and ^{3}H) and its software. For ^{147}Pm analysis, the method standard is run once per quarter. The method standard is always run with a batch of samples for ^{3}H and ^{14}C analysis. The results of the method standard checks the overall performance, including the calibration of the counting system. The instrument calibration check is done a minimum of once a week (refer to LO-150-115).

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)	LA-288-101 LA-508-052 LQ-508-003	Yes	For analysis of gamma emitters ^{95}Nb, ^{95}Zr, ^{134}Cs, ^{137}Cs, and ^{144}Ce the procedure LA-508-052 is followed. Analysis is done on quarterly composites of weekly/ daily air filter samples. For analysis of volatile radionuclides (^{129}I, ^{131}I, ^{106}Rh/^{106}Ru, ^{113}Sn, ^{125}Sb, and ^{103}Ru) collected weekly on silver zeolite cartridge, the procedure LA-288-101 is used in conjunction with procedure LA-508-052. Calibration of the gamma ray spectrometer is done with the procedure documented in LQ-508-003 using a (NIST traceable) certified mixed gamma ray standard. It is carried out only when it is deemed necessary by a responsible scientist. To check efficiency and energy calibration daily, the performance of each detector of the GEA system over the whole energy range is done once every shift by running a mixed gamma standard consisting of ^{241}Am for low energy, ^{137}Cs for mid energy, and ^{60}Co for high energy. The results of each of these radionuclides should fall within the administrative limits set according to the appropriate QAPP to continue analysis of samples. The daily performance results are documented. Minor adjustments of the electronics (e.g., fine gain, pole zero of the amplifiers, lower level discriminator of analog-to-digital converter) are done from time to time when necessary for proper energy calibration. Whenever a minor electronic adjustment is done on a detector, it is followed by analysis of a performance standard. For a major shift in the calibration, the system is then thoroughly calibrated using LQ-508-003.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5	A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)	WHC-CM-5-4, Section 5.4, "Analytical Laboratory Procedures"	Yes	The content of the 222-S Laboratory's procedures, test plans, supporting documents, and drawings provide a sufficient level of detail to allow trained personnel to produce quality results safely. Laboratory procedures are controlled as required by WHC-CM-5-4, Section 5.4, "Analytical Laboratory Procedures." The specific content of laboratory procedures is defined by its author, based on accepted methods such as 40 CFR 61, Appendix B, Method 114 (EPA 1991). The content must be agreed to by the peer and technical reviewers. While authors are responsible for the specific content of their procedures, they address the topics below.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)		Yes	<u>Summary</u>--MANDATORY--A short description or abstract of the procedure containing enough information to distinguish it from other procedures. <u>Applications</u>--MANDATORY--Defines the scope and purpose of the specific procedure. This section may be combined with the following element under the title "Applications and Limitations." <u>Limitations</u>--MANDATORY--Briefly describes those areas in which the procedure is not applicable. A statement of accuracy and precision will be given where appropriate. <u>Quality Control Protocol</u>--Procedures used to support environmental projects that have specific quality control requirements. For these procedures, the source of the quality control requirements will be identified. The samples or project that this element applies to will be identified. The following information is typical of quality control requirements: frequency and type of calibration, reagent blank analysis, spike sample analysis, and duplicate sample analysis.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)		Yes	Impact Level Identifier--MANDATORY--An impact level will be identified for each procedure following WHC-CM-1-3, MRP 5.43, with a brief basis of determination statement. This MRP lists several descriptive paragraphs delineating what constitutes an Impact Level 1, 2, 3, or 4 activity. The following parts of MRP 5.43 cover most analytical laboratory procedures. 1. Section 5, Paragraph 6, Part c., Impact Level 3--work authorization documentation associated with work involving occupational hazards not covered by approved procedure, such as Operational Safety Assessments, Radiation Work Permits, or Industrial Safety Standards. 2. Section 5, Paragraph 6, Part c., Impact Level 4--Documentation for any activity not classed as Impact Level 1, 2, or 3. The laboratories' procedures are usually specific to one activity. These activities are well defined using common scientific instrumentation and equipment operated in an acceptable manner. The chemicals and materials used are normally small quantities with limited potential for environmental or personnel safety impact. In general, the equipment used in the laboratory is not classified as Safety Class 3 or higher.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5	A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)		Yes	Safety--MANDATORY--The procedure must identify applicable safety hazards. The following documents identify Hanford Site safety requirements: • WHC-CM-4-3, Volume 1-3, Industrial Safety • WHC-CM-4-10, Radiation Protection • WHC-CM-4-15, Radiation Work Requirements and Work Permits Manual • WHC-CM-4-29, Nuclear Criticality Safety. Supporting document WHC-SD-CP-LB-003, Safety in the Analytical Laboratory (WHC 1992a), is the laboratory general safety document. The authors must review safety requirements and include safety warnings appropriate to the actions directed by the procedure.
4.3.5	A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)		Yes	Reagents--If the procedure requires analytical reagents, a list of reagents will be provided. The MSDS number will be placed in brackets by each chemical name. Reagent makeup, storage container requirements, unique storage needs, shelf-life requirements, special labeling, and special preparation steps will be included. Special notations for any known or suspected carcinogen as listed on WHC-CM-4-3, Volume 2, Table 1, "WHC Master Carcinogen List," will be made on the reagent list. Reagent preparation described fully in other current Hanford Site documentation may be included by reference. Equipment--Special equipment needs will be listed. Standard hood or glovebox equipment is assumed to be available at the work station and does not need to be listed. The fabrication of off-standard equipment will be referenced or described in this section.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)		Yes	Procedure Steps--MANDATORY--A step-by-step description of operations necessary to perform the task will be presented in a logical and sequentially numbered order or an assignment of responsibilities. CAUTION and WARNING notations will be included for the applicable safety hazard before the action is described. Steps with potential for criticality specification violation will be identified. Explanatory "Notes" may be included for clarification of process. Calculations--Calculations required to complete the work will be described in this section. Examples with sample values may be included. All combined factors will be fully described and units noted. Calibrations--When calibrations are required, a description of how to carry out required calibrations will be given. Discussion--A discussion of the theoretical aspects of the procedure. Brief identification of unique characteristics and interfaces to aid in troubleshooting may be included. References--A reference list of published information to provide technical basis for the procedure may be included.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)		Yes	The mandatory topics are addressed in both procedures. However, the laboratories have technical, analytical, and administrative procedures. Nonmandatory topics are included if appropriate to the activity covered by the procedure. The calibrations of all laboratory instruments are controlled by the Laboratory Instrument Calibration Control System (LICCS) (WHC-CM-5-4, Section 8.2). The LICCS documents the requirements for and the performance of calibration activities for each analytical instrument or measurement device.
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured. including frequency of analysis calibration procedures and frequency of calibration. (Continued)		Yes	The <u>Facility Effluent Monitoring Plan Determination for the 200 Area Facilities</u> (WHC 1991e) lists the analytes of interest for the 291-A-1 Stack. These are: ^{238}Pu, $^{239,240}Pu$, ^{241}Am, $^{89,90}Sr$, Gamma Energy Analysis, Gross U, ^{147}Pm, ^{129}I, ^{131}I, ^{125}Sb, ^{113}Sn, ^{103}Ru, and ^{106}Ru. See Section 3.0 for details on laboratory procedures.

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APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.3.6	A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.	PSCP-1-045 PSCP-4-16 PSCP-4-197 PSCP-7-001	Yes	After exiting the record sample filter, the air flows through a flow measurement and control system. Currently a Kurz[1] Model 505 system measures the sample flow rate, a Kurz model 101-RM totalizes the sample flow, and a Kurz 710RMD(4200) adjusts a control valve to maintain a constant flow. At least once a day an employee adjusts the 710RMD to ensure isokinesis. The instruments are calibrated at least once per year (normally every 6 months). Currently the calibration procedures are PSCP-1-045, PSCP-4-167, and PSCP-4-197. After exiting the flow control valve, the air flows through a rotameter which provides backup indication. Approximately yearly calibration is accomplished by comparison with a standard rotameter, using procedure PSCP-7-001.
4.3.7	A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures and frequency of calibration.	PSCP-1-044 PSCP-4-001 PSCP-4-167	Yes	A six-point Kurz probe continuously measures the flow through the stack at the 74-ft level. A Kurz Model 195B transmitter sends the signal to a Kurz Model 142-RMD and a Kurz Model 132, which then drives a recorder, which continuously records the flow rate. The total flow is then summed from the recorder trace. The six flow elements on the six-point probe are pre-calibrated by the manufacturer. The remaining instruments are calibrated at least once per year (normally every 6 months). Currently the calibration procedures are PSCP-1-044, PSCP-4-001, and PSCP-4-167.

[1]Kurz is a trademark of Kurz Instruments, Inc.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.4	The objectives of the quality assurance program shall be documented and shall state the required precision, accuracy and completeness of the emission measurement data including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.	<u>Environmental Protection Quality Assurance Project Plan</u>, WHC-EP-0528	Yes	The objectives are documented in the Environmental Protection Quality Assurance Project Plan (QAPjP) (WHC 1992)
4.5	A quality control program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include where applicable a system of replicates, spiked samples, split samples, blanks and control charts. The number and frequency of such quality control checks shall be identified.			The program will be described in a future Environmental Protection QAPjP.
4.6	A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage and analysis.	<u>Program Plan for Radionuclide Airborne Emissions Monitoring Program</u>, WHC-EP-0536	Yes	Refer to Section 6.2.3 of WHC-EP-0536.
4.7	Periodic internal and external audits shall be performed to monitor compliance with the quality assurance program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.	<u>Program Plan for Radionuclide Airborne Emissions Monitoring Program</u>, WHC-EP-0536	Yes	Refer to Section 7.0 of WHC-EP-0536.
4.8	A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken and who is responsible for taking the corrective action.	<u>Program Plan for Radionuclide Airborne Emissions Monitoring Program</u>, WHC-EP-0536	Yes	Refer to Sections 4.0 and 7.0 of WHC-EP-0536.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT		PLANT DOCUMENTATION	DOES SYSTEM MEET REQR'MTS?	EXPLANATORY REMARKS
4.9	Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits and description of corrective actions.	Program Plan for Radionuclide Airborne Emissions Monitoring Program, WHC-EP-0536	Yes	Refer to Section 9.0 of WHC-EP-0536.
4.10	Provide qualifications and training needed for Facility Cognizant Engineer.	WHC-CM-5-9, REV 0, Section 2.19, "Selection of PUREX/UO_3 Cognizant Engineers and Cognizant Engineer Managers"	Yes	This procedure establishes the requirements, qualifications, and process for the selection of PUREX/UO_3 Cognizant Engineers and Cognizant Engineer Managers.

Trademarks:

Air Neotronics MP Series 4 Autozero Digital Micromanometer is a trademark of Air Neotronics Limited.

Gelman Veraspor 3000 is a trademark of Gelman Sciences.

Jupiter System, Series 85 is a trademark of Canberra Industries, Inc.

15.0 SUMMARY AND CONCLUSIONS

15.1 MONITORING REQUIREMENTS FOR AIR AND LIQUID EFFLUENTS

15.1.1 Monitoring Requirements for Radioactive Constituents in Air Effluents

Continuous sampling and periodic laboratory analysis are required for Stacks 291-A-1 and 296-A-1. Specific requirements are described below.

15.1.1.1 Stack 291-A-1. Stack 291-A-1 will require continuous sampling for particulates, with analysis for total alpha, total beta, ^{239}Pu, and ^{90}Sr.

15.1.1.2 Stack 296-A-1. Stack 296-A-1 will require continuous sampling for particulates, with analysis for total alpha, total beta, ^{239}Pu, and ^{241}Am.

15.1.1.3 Remaining Stacks. The remaining stacks at the PUREX Plant will not require continuous sampling. However, it is advisable to maintain the existing air monitoring equipment in good working order.

15.1.2 Monitoring Requirements for Radioactive Constituents in Liquid Effluent

All operating liquid effluent wastestreams will be continuously sampled and periodically analyzed for total alpha and total beta radiation.

15.2 SAMPLING REQUIREMENTS FOR AIR AND LIQUID EFFLUENTS

15.2.1 Sampling Requirements for Radioactive Constituents in Air Effluents

Sampling requirements have been given in Section 15.1.1.

15.2.2 Sampling Requirements for Liquid Effluents

Composite and grab samples will be analyzed for radioactive, organic, and nonradioactive inorganic constituents. Composite samples will be collected and analyzed monthly; grab samples will be collected quarterly to verify the data reported in the monthly composite program. In addition, the quarterly analyses will include both GC and GC/MS determinations for organic constituents. The GC and GC/MS methods will be used in alternate quarters to maximize sensitivity in the detection of volatile organic chemicals (GC) and the capability for screening a broad variety of organic chemicals (GC/MS). The sampling and analytical program is detailed in Section 7.2.6.

15.3 SYSTEMS UPGRADES FOR AIR MONITORING AND LIQUID SAMPLING

15.3.1 Systems Upgrades for Air Monitoring/Sampling

15.3.1.1 Stack 291-A-1. The existing equipment at Stack 291-A-1 will not require a system upgrade to meet the sampling needs. Either one of the existing isokinetic sampling systems installed at the 18 m and 22.5 m (60 ft or 74 ft) elevations appear to be adequate for ensuring a representative sample is collected.

15.3.1.2 Stack 296-A-1. The sampling system at Stack 296-A-1 will not require an upgrade to meet the sampling needs. The existing near-isokinetic system appears to be adequate for collecting a representative sample for ^{239}Pu and ^{241}Am analyses.

15.3.1.3 Remaining Stacks. No system upgrades are required for the remaining stacks at the PUREX Plant.

15.3.2 Systems Upgrades for Liquid Sampling

The selection of analytes for characterization is not uniform nor is it consistent with the discharge criteria parameters. Some effluent concentrations exceed the SALDS acceptance criteria. The wastestream characterizations must be refined before discharge to the SALDS commences. (See Table 7-4 for SALDS acceptance criteria.) Sampling and monitoring of the CSL will be conducted according to the SAP.

16.0 ATTACHMENTS

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16.2 STATE APPROVED LAND DISPOSAL STRUCTURE ACCEPTANCE CRITERIA

Acceptance Criteria for the 200 Area Treated Effluent Disposal Facility are displayed in the following table (Table 16-1).

Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.[1] (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
INORGANICS: METALS								
Aluminum					0.06		0.050	S,W
Antimony				0.01/0.005			0.005	W
Arsenic (III)	0.05			0.03		0.00005	0.00005	W
Aresenic (V)	0.05			0.03		0.00005	0.00005	S
Asbestos				7,000 F/mL			7,000 F/mL	S
Barium	1.00			5.0		1.000	1.000	S,W
Boron								
Beryllium				0.001			0.001	S,W
Cadmium	0.01			0.005		0.010	0.005	S
Calcium								
Chromium (VI)	0.05			0.1		0.050	0.050	S,W
Chromium (III)	0.05			0.1		0.050	0.050	S,W
Copper			1.0		1.0	1.000	1.000	S,W
Iron			0.3		0.3	0.300	0.300	S,W
Lead	0.05			0.011/0.005		0.050	0.005	S
Magnesium								
Manganese			0.05		0.05	0.050	0.050	S,W
Mercury	0.002			0.002		0.002	0.002	S,W
Nickel				0.1			0.100	S,W
Phosphorous								
Potassium								
Selenium	0.01			0.05		0.010	0.010	S,W
Silicon								
Silver	0.05				0.09	0.050	0.050	S,W
Sodium								
Thallium				0.002/0.001			0.001	S
Uranium								
Vanadium								
Zinc			5.0		5.0	5.000	5.000	S,W
INORGANICS: IONS								
Ammonium								
Carbonate								
Chloride			250.0		250.0	250.00	250.00	S,W
Cyanide				0.200			0.200	S
Fluoride	4,000	4,000	2,000	4,000	2,000	4,000	2,000	S
Nitrate (as Nitrogen)	10.00			10.0		10.000	10.000	S,W
Nitrite (as Nitrogen)				1.000			1.000	S
Sulfate			250.0	400/600	250.0	250.000	250.000	S,W
Sulfide								

Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.[1] (7 sheets)

Analytical category: Analytes of interest	SDWA Drinking Water Standards Current MCL (mg/L)	SDWA Drinking Water Standards Current MCLG (mg/L)	SDWA Drinking Water Standards Current SMCL (mg/L)	SDWA Drinking Water Standards Proposed MCL (mg/L)	SDWA Drinking Water Standards Proposed SMCL (mg/L)	WPCA Groundwater quality standards (mg/L)	WPCA Most restrictive limit (mg/L)	Basis
MISCELLANEOUS								
Ammonia						20.00**	20.0	W
Corrosivity			Noncorr.		Noncorr.	Noncorr.	Noncorr.	S,W
Color			15 CU		15 CU	15 CU	15 CU	S,W
Foaming Agents			0.5		0.5	500.0	0.5	S,W
Ores			3 TON		3 TON	3 TON	3 TON	S,W
pH			6.5-8.5		6.5-8.5	6.5-8.5	6.5-8.5	S,W
Total Dissolved Solids			500.0		600.0	500.0	500.0	S,W
Direct Black 38						0.000009	0.000009	W
Direct Blue 6						0.000009	0.000009	W
Direct Brown 95						0.000009	0.000009	W
RADIONUCLIDES								
^{241}Am								
^{137}Cs								
^{155}Eu								
Gross Alpha	15 pCi/L					15 pCi/L	15 pCi/L	S,W
Gross Beta	4 mrem/yr					20 pCi/L	20 pCi/L	W
^{129}I								
^{238}Pu								
^{239}Pu								
^{240}Pu								
^{241}Pu								
^{147}Pm								
^{226,228}Ra	5 pCi/L					5 pCi/L	5 pCi/L	S,W
^{225}Ra	3 pCi/L					3 pCi/L	3 pCi/L	S,W
^{103}Ru								
^{106}Ru								
^{80}Sr						8 pCi/L	8 pCi/L	W
^{103}Sn								
Tritium						20,000 pCi/L	20,000 pCi/L	W
ORGANICS: PAHs								
Polynuclear Aromatics						0.00001	0.00001	W
Hydrocarbons (PAHs)								
Benzo(a)pyrene				0.0002		0.000008	0.000008	W
Benzo(a)anthracene				0.0001			0.0001	S
Benzo(b)fluoranthene				0.0002			0.0002	S
Benzo(k)fluoranthene				0.0002			0.0002	S
Chrysane				0.0002			0.0002	S

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Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.[1] (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
ORGANICS: PAHs (continued)								
Dibenz(a,b)-anthracene				0.0003			0.0003	S
Indenopyrene				0.0004			0.004	S
ORGANICS: BENZENES								
Azobenzene						0.0007	0.0007	W
Benzene	0.005	0.000		0.005		0.001	0.001	W
1,4-Dichlorobenzene						0.004	0.004	W
para-Dichlorobenzene	0.075	0.075		0.076	0.005		0.005	S
ortho-Dichloro-benzene				0.6	0.01		0.01	S
Ethylbenzene				0.7	0.03		0.03	S
Hexachloroenzene				0.001		0.00005	0.00005	W
Monochlorobenzene				0.1			0.1	S
1,2,4-Trichloro-benzene				0.009			0.009	S
o-Chloronitrobenzene						0.003	0.003	W
p-Chloronitrobenzene						0.005	0.005	W
ORGANICS: OTHER AROMATICS								
Benzotrichloride						0.000007	0.000007	W
Styrene				0.005/0.1	0.01		0.005	S
Toluene				2.0	0.04		0.04	S
2,6-Dinitrotoluene						0.0001	0.0001	W
2,6-Dinitrotoluene						0.0001	0.0001	W
p,a,a,a-Tetrachlorotoluene						0.000004	0.000004	W
Xylene (total)				10.0	0.02		0.02	S
ORGANICS: PHENOLICS								
Pentachloropnenol				0.2	0.03		0.03	S
2,4,5-Trichloro-phenol						0.004	0.004	W
ORGANICS: PHTHALATES								
Bis(2-ethylhexyl) phthalate				0.004		0.006	0.004	S
Butylbenzylphthalate				0.1			0.1	S
Methylene chloride (Dichloromethane)						0.006	0.006	W
Trichloromethane (Chloroform)	0.1					0.007	0.007	W
Total Trihalomethanes	0.1						0.1	S
Dibromochloro-propane				0.0002			0.0002	S
1,2-Dichloropropane				0.006		0.0006	0.0006	W

Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.[1] (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
ORGANICS: ADIPATES								
Di(ethylhexyl)-adipate				0.5			0.5	S
ORGANICS: ALKANES								
1,1-Dichloroethane						0.001	0.001	W
1,2-Dichloroethane	0.005	0.0		0.005		0.0005	0.0005	W
1,1,1-Trichloro-ethane	0.2	0.2		0.2		0.200	0.2	S,W
1,1,2-Trichloro-ethane				0.006			0.006	S
Bromodichloromethane						0.003	0.003	W
Bromoform						0.005	0.005	W
Carbon tetrachloride	0.005	0.0		0.005		0.0003	0.0003	W
Chlorodibromomethane						0.00055	0.0005	W
1,2 Dibromoethane						0.000001	0.000001	W
ORGANICS: ALKENES								
1,1-Dichloroethylene	0.007	0.007		0.007			0.007	S
cis-1,2-Dichloro-ethylene				0.07			0.07	S
trans-1,2-Dichloro-ethylene				0.1			0.1	S
Tetrachloroethylene				0.005		0.0008	0.0008	W
Trichloroethylene	0.005	0.0		0.005		0.003	0.003	S
Ethylene dibromide				0.00006		0.000001	0.000001	W
1,3-Dichloropropene						0.0002	0.0002	W
Hexachlorocyclo-pentadiene				0.05	0.005		0.005	S
Vinylchloride (Ethylenechloride)	0.002	0.0		0.002		0.00002	0.00002	S
ORGANICS: NITRILES								
Acrylonitrile						0.00007	0.00007	W
ORGANICS: AZINES/AZIDES								
1,2-Dimethyl-hydrazine						0.060	0.06	W
1,2-Diphenylhydrazine						0.00008	0.00008	W
Hydrazine/Hydrazine sulfate						0.00003	0.00003	W
ORGANICS: AMINES								
Aniline						0.014	0.014	W
4-Chloro-2-methyl-aniline						0.0001	0.0001	W
4-Chloro-2-methy-laniline hydrochloride						0.0002	0.0002	W

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Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.[1] (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
ORGANICS: AMINES (continued)								
2-Methoxy-6-nitroaniline						0.002	0.002	W
2-Methylaniline						0.0002	0.0002	W
2-Methylaniline hydrochloride						0.0005	0.0005	W
4,4'-Methylene bis(N,N'-dimethyl)-aniline						0.002	0.002	W
3,3'-Dichlorobenzidine						0.0002	0.0002	W
3,3'-Dimethoxybenzidine						0.006	0.006	W
3,3'-Dimethylbenzidine						0.000007	0.000007	W
Dimethyinitroamine						0.0000007**	0.0000007	W
N-Nitroso-di-n butylamine						0.00002	0.000002	H
N-Nitrosodi-ethanolamine						0.00003	0.00001	H
N-Nitrosodi-ethylamine						0.00000006	0.0000006	W
N-Nitrosodi-methylaimine						0.000002	0.000002	W
N-Nitroso-n-methyl-ethylamine						0.000004	0.000004	W
N-Nitrosodi-phenylamine						0.017	0.017	W
N-Nitroso-di-n-propylamine						0.00001	0.00001	W
N-Nitrosopyrroidine						0.00004	0.00004	W
o-Phenylenediamine						0.000005	0.000005	W
2,4-Toluenediamine						0.000002	0.000002	W
o-Toluidine						0.0002	0.0002	W
ORGANICS: ETHERS								
Bis(chloroethyl)-ether						0.00007	0.00007	W
Bis(chloromethyl)-ether						0.0000004	0.0000004	W
1,4-Dioxane						0.007	0.007	W
ORGANICS: BIPHENYLS								
Polychlorinated biphenyls (PCBs)				0.0005		0.00001	0.00001	W
Polybrominated biphenyls (PBBs)						0.00001	0.00001	W

Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.[1] (7 sheets)

Analytical category: Analytes of interest	SDWA Drinking Water Standards Current MCL (mg/L)	SDWA Drinking Water Standards Current MCLG (mg/L)	SDWA Drinking Water Standards Current SMCL (mg/L)	SDWA Drinking Water Standards Proposed MCL (mg/L)	SDWA Drinking Water Standards Proposed SMCL (mg/L)	WPCA Groundwater quality standards (mg/L)	WPCA Most restrictive limit (mg/L)	Basis
ORGANICS: DIOXINS/FURANS								
2,3,7,8-TCDD (Dioxin)				0.00000006		0.0000000006	0.0000000006	W
Hexachlorodibenzo-p-dioxin						0.00000001	0.00000001	W
ORGANICS: MISCELLANEOUS								
Acrylamide						0.00002	0.00002	W
Benzylchloride						0.0005	0.0005	W
Carbazols						0.006	0.006	W
Chlorthalonil						0.030	0.030	W
Epichlorohydrine						0.006	0.006	W
Ethoxytriethylene-glycol								
Ethyl acrylate						0.002	0.002	W
Ethylene thiourea						0.002	0.002	W
Furium						0.000002	0.000002	W
Furmecyclox						0.003	0.003	W
Mirex						0.00005	0.00005	W
Nitrofurazone						0.00006	0.00006	W
Propylene oxide						0.00001	0.00001	W
Trimethyl phosphate						0.002	0.002	W
ORGANICS: PESTICIDES								
Alachlor				0.002			0.002	S
Aldicarb				0.01			0.010	S
Aldicarb sulfoxide				0.01			0.010	S
Aldicarb sulfone				0.04			0.040	S
Aldrin/Dieldrin						0.000006	0.000006	W
Aramite						0.003	0.003	W
Atrazine				0.003			0.003	S
Carbofuran				0.04			0.040	S
Chlordane				0.002		0.00006	0.00006	W
2,4-D	0.1			0.07		0.100	0.070	S
Daiapon				0.2			0.200	S
DDT						0.0003	0.0003	W
Diallate						0.001	0.001	W
Dichlorvos						0.0003	0.0003	W
Dieldrin						0.000005	0.000005	W
Dinoseb				0.007			0.0070	S
Dique\as				0.02			0.020	S
Endothall				0.1			0.100	S
Endrin	0.0002			0.002		0.0002	0.0002	W,S
Furazolidone						0.00002	0.00002	W

Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.[1] (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
ORGANICS: PESTICIDES (continued)								
Folpet						0.020	0.020	W
Glyphosphate				0.7			0.700	S
Heptachlor (and hydroxide)				0.0004		0.00002	0.00002	W
Heptachlor epoxide				0.0002		0.000009	0.000009	W
Hexachlorocyclo-hexane (alpha)						0.000001	0.000001	W
Hexachlorocyclo-hexane (technical)						0.00005	0.00005	W
Lindane	0.004			0.0002		0.00006	0.00006	W
Methoxychlor	0.1			0.4		0.100	0.100	W,S
Oxamyl(vydate)				0.2			0.200	S
Pholoram				0.6			0.600	S
Simazine				0.001			0.001	S
ORGANICS: PESTICIDES								
Toxaphene	0.006			0.005		0.00006	0.00006	W
2,4,5-TP (Silvex)	0.01			0.05		0.010	0.0100	W,S

[1]This table is compiled from regulatory levels published in the Federal Safe Drinking Water Act and the Washington State Water Pollution control Act. The 200 Area waste streams intended for disposal in the TEDF are expected to contain some constituents that are not identified on this table. The Water Quality Standards for the State of Washington (WAC 173-200) state. "Where a criterion is not established for a contaminant, the enforcement limits in ground water shall equal the practical quantification level except: (a) where there is evidence that a lower concentration would better protect human health and the environment (based on published health advisories, risk assessments and other available information), the department shall establish a more stringent enforcement limit (b) if clear and convincing evidence can be provided to the department's satisfaction that an alternative concentration will provide protection to human health and the environment, the department may establish an enforcement limit higher than the practical quantification level."

MCL = Maximum contaminant Level
MCLG = Maximum Contaminant Level Goal
SDWA = Federal Safe Drinking Water Act
SMCL = Secondary Maximum Contaminant Level
TON = Threshold Odor Number
WPCA = Washington State Water Pollution Control Act
mg/kg = milligrams per kilogram
F/mL = fibers per milliliter
pCi/L = picocuries per liter.
•Based on human health criteria for carcinogens. Value presented is based on 1.0 E-06 risk level.
••Calculated, using MTCA and WPCA formulas, and available reference dose and/or cancer potency factor data.
*Criteria is hardness dependent. Assumed harness equal to 30 mg/L as $CaCO_3$.
**Criteria is pH dependent. Assumed pH equal to 7.0.
***Criteria is pH and temperature dependent. Assumes pH equal to 7.0 and temperature equal to 20 °C.

Column marked "Basis" indicates source of "Most restrictive limit:"
H = Health Based Limits
L = Land Disposal Restrictions
P = PQL
S = SDWA
W = WPCA.

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